Vol. I SEPTEMBER 1923 No. 2

PEABODY JOURNAL OF EDUCATION

CONTENTS

Ebb and Flow — *C. A. McMurry*

Age-Grade-Sex Percentile Norms for Woody-McCall Arithmetic Tests — *S. C. Garrison and Florence Ryan*

The Effect of Knowledge of Results Upon Oral and Silent Reading — *Pantha Vashti Harrelson*

Starting the Small Physics Laboratory — *H. A. Webb*

Geographical Knowledge Up to the Time of Augustus — *Sara Lois Grime*

The Teacher and Children's Reading — *Charles H. Stone*

A Brief Study of Illiteracy in the United States — *Roucher Horton*

A Plan to Encourage Home Reading — *Elizabeth Smith*

Editorials

Book Reviews

Published bimonthly by the Faculty of
GEORGE PEABODY COLLEGE FOR TEACHERS
NASHVILLE TENNESSEE
Two dollars a year Single copies 40 cents

PEABODY JOURNAL OF EDUCATION

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Edited and Published by

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NASHVILLE, TENNESSEE

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PEABODY JOURNAL OF EDUCATION

VOLUME I SEPTEMBER 1923 NUMBER 2

EBB AND FLOW

CHARLES A. McMURRY
George Peabody College for Teachers

We have witnessed, in our time, a number of strong educational movements which have swept over the country like tidal waves. One after another they have engulfed us and swept us along with their current. The more striking features of our recent educational history are embodied in these reform movements. Taken together, they constitute a memorable epoch.

In this paper I shall mention, and describe, five of these propagandist upheavals which have disturbed our serenity and set things agog.

The first was the literary revival—a modern renaissance—the warm and hearty acceptance into the common school of the famed literary products of the world. From the primary school down—down the long road to the high school and college—there were incorporated into curricula such masterpieces as the stories of Ulysses, Joseph, Crusoe, Theseus, Ivanhoe, and Rip Van Winkle, the rimes of Mother Goose, much excellent poetry, the tale of Beauty and the Beast, the adventures of Aladdin and of Sinbad, and the epic lay of the patriot, Horatius. Under the inspiration of this revival, eager and scholarly teachers have sought in the literatures of many nations appropriate stories, poems, dramas, and hero tales. These idealized human experiences, the inner spirit and mind of the world's masters of thought, are daily caught up and absorbed into the active minds of children, as if these little ones deserved to live only in kings' gardens and in the company of the princes of the earth.

This renaissance of literature for public-school use is democratic

in its purport. It ventures to bestow upon every child the magic gifts of beauty and sweetness and light, as they are brought to children in lively messages from Stevenson and Grimm, from Dickens and Homer and Kingsley, from Longfellow and Scott and Hawthorne, and from Hans Anderson, George Eliot, and the Bible. In their pardonable excess of zeal, some idealistic reformers have believed that education would reach its acme of excellence wherever and whenever school men were wise enough to incorporate into studies and to make effective in the thoughts of children the refining spiritual and æsthetic qualities which, though intangible, are yet so real in literature.

The wise and generous use of carefully sifted literature in the schools is of such high merit that it has been exalted by enthusiasts to the rank of a superior cult. When the literary revival was at its height, there was a glowing enthusiasm in its behalf which expressed itself in a propaganda of books and discussion. A general uplift in educational standards was prophesied on the basis of this new, superior literary training. But gradually the extreme enthusiasm for such idealistic use of literature waned, and the high achievements expected in this revival were not fully realized. In fact, such high achievements must be the result of steady progress through a long period of years, and not the outcome of a transient, overwrought enthusiasm.

There is a fundamental need, in season and out, for a steady, glowing enthusiasm for the refining and strengthening qualities of good literature. Its beauty and idealism generate in children a high spiritual energy, whose loss cannot be made good by any substitute. But the tendency to backslide from inspiring ideals once clearly set up—too enthusiastically and uncritically, perhaps—is the aftermath of this as of all other progressive movements. In dealing with educational standards and ideals once carefully defined, we cannot afford to backslide. The higher qualities of select literature should be a constantly prevailing, strengthening, and formative influence in school life, not a momentary, transient enthusiasm. In the development of a child there should be a steady, uninterrupted progress into the realms of ideal experience.

In consequence of our regressive, even slothful, relapse from former ideals in literary instruction, the struggle must be taken up again from the start. There is not yet established on a high level the tradition of superior literary teaching in the schools as a whole. We caught a glimpse of the promised land and then let the vision fade, while we turned our sporadic attention to other things.

A second powerful propagandist advance in education was a confident and enthusiastic rush into the fields of natural science. Twenty-five years ago the forerunners and prophets of this move-

ment were the eloquent advocates of science in the school program. They were men who followed Huxley, Gray, and Agassiz, and demanded that teachers and children alike awaken to the real things of life, to the beauty and utility everywhere so concretely visible in nature's works. The whole school program would be lifted out of the dumps, and people aroused to new and unheard-of achievements, if only scientific studies were given free course in the classroom. One proof of this assertion is that modern progress is scientific. Scientific discovery and invention are shifting the scenes so rapidly that without such studies one cannot even keep track of what is going on about one. Science, being objective, concrete, and dynamic, appeals directly to the senses and activities of children. It also plays everywhere into the practical uses and concerns of later, adult life.

The advocates of scientific observation and study in the elementary schools were boundlessly enthusiastic. They were fully convinced that they had discovered the educational elixir, and that popular education had at last, through their guidance, come into plain view of the promised land. They were proud to be the first to enter upon this glorious era of the new education. From this time on development in school was to be natural, wholesome, and appropriate to human needs.

Moreover, the realm of the natural sciences is exceedingly broad and many-sided—no narrow, ten-acre lot, but a wide and varied universe, a realm also of law and order, where God's works manifest themselves in infinite variety, beauty, and utility. As a result, nature-study lessons gradually took on many phases. There were outdoor excursions to study bees, flowers, gardens, trees, shrubs, rocks, hills, streams, and forests. There were indoor experiences in laboratories and workshops, to study, with test tubes and apparatus, agriculture, biology, health and hygiene, and dietetics. There was scrutiny of scientific inventions like telescopes, thermometers, steam engines, and electrical machines. There were observations of storms and weather phenomena, of the human body in health and disease, of the applications of science to industries, and of the sun and the solar system.

On account of its widening of interests and its novelties, this joyride into the sciences lasted for a period of years and greatly influenced all educational ideas and practice, but it began at length to lose its dominance. It gradually dwindled and dropped off—we might almost say "flattened out." It has, indeed, left a wholesome and liberalizing influence, but it has now long since passed the climax and settled down into the commonplaces of the school. Little

is now said about nature studies in teachers' assemblies and public meetings. The excitement is over. Science now quietly takes its place as one of a group of six or eight principal studies in the school.

It is, nevertheless, a depressing misfortune to lose the high enthusiasm which once prevailed for nature and science. A realm of marvels and vast resources is, indeed, therein to be uncovered and made tributary to human needs. Every child should be inducted by wise and enthusiastic teachers into nature's combination of wonders and utilities. No other study can take the place of science. No teacher is quite fit who is blind to nature—who does not listen to the song of birds or look with interest into the starry heavens. There should be no backsliding into a dull and unappreciative routine of nature study. Yet we have not far escaped it. No one will now say that we have even approximately solved the problem of science studies in the elementary school. It is still an open problem—one of unlimited, unrealized opportunity and importance.

A third forward lunge in progressive education is seen in the recent effort to exploit those twin subjects, geography and history. In late years much zeal and energy has been expended upon these two. They are so intimately bound together in the bundle of life that all effort to divorce them seems foolish and artificial. In fact, the correlation of these subjects with each other and with science and mathematics is so close and intricate that the problem of a broader grouping and organization of these subjects seems to be forced upon our attention. Historians and geographers, by arranging all studies more or less around historical and geographical centers, would give these a commanding place in the curriculum. They may, indeed, deserve such high honors, because they are full and brimming over with human interests. They deal with people in their fundamental relations to the physical world. They embrace the market place, the farm and the forest, the factories, the city streets and the ocean ports, the home, the church, the courthouse, the senate chamber, the cabinet meeting and the battle field, the canal, the railroad, and the merchant fleets. It is not strange that high claims are set up for studies that include the great biographies and historic enterprises, that deal with human achievements like the Panama Canal, with water powers like Niagara, and with all the vast earth forces of land and sea.

Yet, strange to say, this glowing enthusiasm for great studies in geography and history fluctuates and even dies out, or it drops down to the level of humdrum. Enthusiasm wanes and a tedious and wearisome routine takes possession of the school. A downward slump in these studies, as in others, has been the curious outcome of all the

fun and frolic and the aggressive zeal of their earlier much-promising stages.

Why this backward step? Why cannot educators keep up the high spirit of endeavor, and carry masterly projects in education to an ever-higher level of achievement and of steady progress?

Fourth, one of the most aggressive and sustained movements in modern education has been the broad survey and layout of courses in industrial and household arts. The original cogent argument in support of these studies was their manifest utility—their complete dominance in the pressing affairs of daily life. They develop and emphasize usable knowledge in home duties and in the universal trades and occupations. Manual training and shop work develop also physical and motor skill, which are of prime importance both in mental and physical growth.

This argument in favor of increased skill in the fundamental arts of life, upon which civilization rests, gained a strong hold on the practical American mind.

More recently this utility argument has been reënforced by a strong æsthetic principle which, in combination with the bread-and-butter view, gives it unusual force. The industrial and household arts have lately formed a close partnership with the fine arts, with drawing and design, and have become thereby the most favored field for the application of the fine arts. Every useful project worked out becomes an æsthetic achievement. This superior principle of æsthetic design, entering into every project, lifts all these common arts to the higher level of refinement in taste.

Such union of utility with art in common crafts opens up one of the most promising and far-reaching outlooks for educational progress. The development of the fine arts in close union with domestic science and industrial arts holds out high hopes for the future. Thus far it has made scarcely more than a faint beginning.

The fifth propulsive movement toward educational betterment lies in the direction of good health and physical welfare. It deserves all the zeal and heartiness that have been put into it, and much more. "Health," "hygiene," and "sanitation" have become talismanic words in modern social progress. From earliest childhood, to provide for all children the conditions favorable to healthy growth, to protect them against disease and malnutrition, to give strengthening games and exercise for the body, to insure fresh air and good housing at home and at school, to provide proper mingling of physical and mental activities through the period of educative development—these are superior aims of the highest significance.

Here, again, the first enthusiasm of an ardent propaganda tends

now to wane, and difficulties pile up in the face of such a beneficent movement. It would cost an astonishing sum of money, for instance, to finance a wise and sustained effort to put such a program of health education into successful execution. We have been enthusiastic, but have as yet done little more than open our eyes, and perhaps our minds, to take in the vast possibilities for good in such a glorious program of health.

In this short paper, five of the educational drives that have been made in successive impulses during the last thirty years and more have been briefly summarized. Like a tidal wave, each of these movements (and, indeed, some others) has swept the land, has exhibited for a time a strong and wise enthusiasm, only to wane or subside when some new movement came on apace. We may gaze in retrospect upon this whole series of efforts and become fully awake to the fact that in them the school world has had five really great dreams of what education might and ought to be.

Their fleeting history seems to show that the enthusiasm of educators has not sufficient strength and scope for more than one propagandist movement at a time, and that none of the five which have swept over us has been steady and persistent enough to attain lasting results—that is, to place our schools permanently upon a high level of achievement. We give ourselves for a period of time to one impulse, to one wave of progress, and before it has had time to standardize and to realize its aims, we let it decline and sink back into much the old ways, while another wave pours in and we ride to its crest, only to fall back again. No doubt these five movements or efforts ought to be organized into one aggressive campaign—one sweeping educational reform.

What would happen if the world of education should some day accumulate enough wisdom, perspective, and steady energy to carry its great enthusiasms forward in one grand, intelligent, sustained movement for educational betterment?

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AGE-GRADE-SEX PERCENTILE NORMS FOR SOME EDUCATIONAL TESTS

I. *WOODY-McCALL MIXED FUNDAMENTALS ARITHMETIC TESTS*

S. C. GARRISON and FLORENCE RYAN
George Peabody College for Teachers

Standardized tests have become so firmly fixed in our educational thinking that no one need make apology for offering data to be used by those who are working with tests. During the last few years we have been flooded with tests of all kinds. Some of these are good and, with further modifications, will survive. Many are probably worth very little and should be discarded. What we need at this stage of the testing movement is not a multiplicity of tests, but further perfection and standardization of existing tests, plus—perhaps most important of all—better methods of presenting and using the results.

The purpose of the present article is to present data on certain test results in such a way that they can be used by teachers and other school workers for comparative purposes. During the last three years one of the writers has been collecting scores made by Southern children in several states when given certain educational tests. To these are added a number of scores made this year by children in Tennessee. Probably one-third of the scores used here were made by children in Tennessee, principally in Nashville. The rest were secured from other Southern states, approximately the same number from each state. In all, results have been used from over one hundred cities and towns. About two-thirds of the scores came from schools employing less than fifteen teachers. In many cases the results were secured from only one grade in each system. The number of scores used is shown for each grade in the tables.

Some of this material has been presented elsewhere[1] in the form of percentile tables. Here we have gone further. The scores have been tabulated on the basis of age, grade, and sex, so that we now present age-grade-sex percentile norms for certain educational tests. In this article, results from the Woody-McCall mixed fundamentals arithmetic test are used. Results from several other tests will be presented in subsequent numbers of this journal. We have presented the mate-

[1] *The Virginia Teacher*, Vol. II, Nos. 9, 10.

rial in the form of percentile tables, because experience has shown that the median (or norm) is not enough for the teacher to know. Much testing in the past has had little or no value, either because the persons doing the testing did not know how to handle the results or because they did not have at hand data with which to make a comparison. In these tables the 50-percentile is the median.

Age-grade-sex percentile norms make it possible for us to compare an individual score of a pupil with the scores of other individuals in the homogeneous group to which he belongs. The achievement of a ten-year-old boy in the sixth grade should be compared with that of a group of ten-year-old boys in that grade. The individual should always be compared first with the group to which he belongs. There are other methods of comparison, but probably none so easily understood. The percentile table makes it possible to rank a pupil on a scale of one hundred. It shows us immediately what per cent of the pupils of his group are above, and what per cent are below, him in achievement. It obviates the necessity of comparing pupils of one age and sex with those of another.

In our testing we must always remember that we are not examining grades, but individual children. Our results will be worth most when we are able to study the individual child rather than the grade.

The percentile tables were made in the way illustrated in Table I below. First, all the scores made by the pupils in a grade were tabulated according to age and sex so as to show the number of pupils of

TABLE I

Showing Distribution of Scores in the Woody-McCall Mixed Fundamentals in Arithmetic Test for Fourth-Grade Boys

Score	*Pupils*
20	2
19	4
18	9
17	16
16	12
15	7
14	10
13	32
12	20
11	28
10	37
9	43
8	36
7	31
6	27
5	20
4	17
3	14
2	11
1	4
Total	380

a given age and sex making a certain score. Here, for instance, two pupils make a score of 20, four a score of 19, and so on. Next, the total number of pupils was found. The high and low scores were determined by inspection, and a table arranged as in Table II.

"High" means the highest score made by any pupil and not necessarily the highest possible score, although it does mean that in some cases. In the same way, "Low" means, not always the lowest possible score, but the lowest score made. One was the lowest score made by a nine-year-old boy and 20 the highest.

Since there are in this table 380 scores made by nine-year-old boys, we find the 10-percentile by taking 10 per cent (38) of the total number and counting up the column headed "Pupils" until we find the 38th pupil. The score made by this pupil is the 10-percentile. In most cases it is necessary to interpolate between scores to find the true percentile. In this case, 29 pupils made a score of 3 or less. However, we need 38 pupils; so we take 9 of the 17 pupils, making a score 4, or 9/17 of one (the distance from score 4 to score 5), and add this to 4. Thus the 10-percentile is 4.5. In the same way the other percentiles are found.

Using the column for nine-year-old boys in Table II as an example, percentile norms should be read in the following manner: The highest score made by any nine-year-old boy in the fourth grade was 20; the lowest, 1. Ten per cent of the nine-year-old boys of the fourth grade, as a rule, make a score of less than 5 (4.5). Twenty per cent make a score of less than 7 (6.4). The rest of the column is read in like manner when read from bottom to top. If we read from the top, we find that 90 per cent make a score of 16 or less. This means, of course, that if a pupil makes a score of 17 or more he is in the best 10 per cent.

Through the use of percentile norms the teacher is able to study and compare her pupils in a much more definite way than by means of median norms alone. For example, 33 children in a fourth grade made the following scores when given the Woody-McCall arithmetic test: 21, 21, 20, 20, 19, 19, 19, 18, 18, 18, 18, 18, 18, 17, 17, 16, 16, 15, 15, 14, 14, 14, 14, 13, 13, 13, 10, 9, 9, 9, 5, 4, 4.

Since there are 33 scores here, the median is the 17th score. The median then is 16. This tells us how the grade as a whole ranks, but tells very little about the individual pupils. The average age of the pupils in this grade is a little over eleven. Now, what we really want to find out is how these pupils compare with others of their age and sex in the same grade and in higher grades. Are these pupils as efficient as other pupils of the same age and sex in the same grade? Are they as efficient as others in a higher grade? As a matter of fact,

two-thirds of these pupils compare very favorably with similar pupils in the fifth grade. Although this grade is listed as a fourth grade, many of the pupils are doing sixth-grade work. Because of age and achievement, many of these pupils would profit more by a sixth-grade environment.

Another advantage of having percentile tables for the various educational and mental tests lies in the fact that they make possible the comparison of pupils by means of different tests. For example, suppose that a pupil has the following scores: Hillegas composition, 4.5; Woody-McCall arithmetic, 7; Thorndike handwriting, 11; Ayres spelling, 75 per cent; Thorndike-McCall reading, 53. We might desire to know whether this pupil was doing good work in all his subjects. His scores alone will not tell us this. The best way to compare his achievement in the various subjects is by means of percentile tables. If he stands at the 60-percentile on one and at the 60-percentile on another, we know that he is doing equally well on both. Suppose, however, that he stands at about the 60-percentile on four tests and at the 30-percentile on one. We then know that something is wrong with respect to his work in the one subject. In the same way, if a whole grade stands well in some of the subjects and low in others, we know that the teacher is not getting the proper work done in some of them.

Not only do percentile tables enable teachers to see just where each pupil stands when compared with a large number of pupils, but they equip teachers to use accurate comparisons for purposes of motivation. The writers have tried the experiment of pointing out to pupils just where they stand when compared with others, and have found this a very powerful incentive for work. Children like to try to improve so that they will stand in a higher percentile at the next testing.

The age-grade-sex percentile norms for the Woody-McCall test on mixed fundamentals in arithmetic are presented in Tables IIa to IIj, inclusive:

TABLE IIa

Age-Grade-Sex Percentile Norms for Woody-McCall Mixed Fundamentals in Arithmetic—Fourth-Grade Boys

PERCENTILE	AGES							
	8	*9*	*10*	*11*	*12*	*13*	*14*	*15*
High	21	20	21	27	21	18		
90	17.1	16.4	15.4	15.1	14.8	14.1		
80	14.6	13.5	12	12.4	12	12.2		
70	11.7	11.9	10.3	11.8	12.2	12.2		
60	10.5	10.7	10.2	10.2	11.3	11.4		
50	9.1	9.7	9.4	9.7	10.2	10.4	10.1	12.3
40	8.7	8.8	9.1	8.8	9.3	9.5		
30	7.1	7.7	8	8	8.4	8.2		
20	6.1	6.4	6.7	7.2	7.5	7.7		
10	4.9	4.5	5	5.9	5.3	6.1		
Low	0	1	0	3	2	2		
No. of Pupils	224	380	247	210	199	109	73	56

TABLE IIb

Fourth-Grade Girls

PERCENTILE	AGES							
	8	*9*	*10*	*11*	*12*	*13*	*14*	*15*
High	19	20	20	22	19			
90	16.9	17.3	14.4	15.5	16.5			
80	14.8	13.9	12.4	13.2	15			
70	12.7	12.3	11.6	11.4	13.8			
60	10.6	11.2	10.9	10.4	12.6			
50	9.6	10.2	10.3	9.6	11.5	10.1	12.2	10.5
40	9	9.5	9.4	8.6	10.4			
30	8.2	8.9	8.3	7.7	8.9			
20	7	7.7	7.4	6.9	8.2			
10	5.3	5.9	6.2	5.7	6.6			
Low	2	3	1	0	1			
No. of Pupils	212	356	367	269	162	91	61	21

TABLE IIc

Fifth-Grade Boys

PERCENTILE	AGES						
	9	*10*	*11*	*12*	*13*	*14*	*15*
High	32	31	33	26	24		
90	21.3	22.1	18.8	18.8	17.8		
80	19.2	19.7	17.7	16.6	16.4		
70	17.8	18.6	16.7	15.4	15.4		
60	17.3	16.4	16	14.6	14.4		
50	16.7	15.5	15	13.7	13.2	12.8	12.1
40	16	13.9	14.1	12.6	12.4		
30	14.7	12.9	13.1	11.7	11.7		
20	12.1	11.6	12.1	11.2	10.7		
10	10.6	10.6	11	10.3	9.3		
Low	6	2	3	4	6		
No. of Pupils	103	487	392	329	190	117	53

TABLE IId

Fifth-Grade Girls

PERCENTILE	AGES						
	9	*10*	*11*	*12*	*13*	*14*	*15*
High		29	25	22			
90		19.8	19.7	18.3			
80		17.9	17.8	17.2			
70		16.8	16.8	16.4			
60		15.7	16	15.6			
50	17.3	14.6	15.6	14.9	13.6	13.6	14.7
40		13.6	14.9	14.2			
30		13	13.7	13.3			
20		10.1	12.1	12.1			
10		9.3	10.3	10			
Low		5	7	6			
No. of Pupils	78	475	307	225	121	124	39

TABLE IIe

Sixth-Grade Boys

PERCENTILE	AGES						
	10	*11*	*12*	*13*	*14*	*15*	*16*
High		31	31	30			
90		25	25.8	25			
80		22.9	23.8	21.6			
70		21.7	21.1	19.8			
60		20.6	20.3	19.2			
50	22	19.1	18.7	18.5	18.7	20.6	24.5
40		16.9	17.5	17.2			
30		16.1	16.5	15.8			
20		13.7	14.2	13.2			
10		11.9	12.1	11.5			
Low		8	8	8			
No. of Pupils	63	357	286	150	77	41	11

TABLE IIf

Sixth-Grade Girls

PERCENTILE	AGES						
	10	*11*	*12*	*13*	*14*	*15*	*16*
High	32	33	31	31			
90	23.8	25.7	26	24.4			
80	22.6	23.4	23.3	22.3			
70	21.9	21.8	21.2	19.9			
60	20.8	20.9	20	19.2			
50	20.1	19.8	18.7	18.7	19.7	20	16
40	19.6	19.2	16.8	15.9			
30	19.1	18	15.4	15.5			
20	18.5	16.2	14.2	14.2			
10	17.3	14.5	12.3	13.2			
Low	10	11	8	11			
No. of Pupils	128	396	242	138	59	23	7

TABLE IIg

Seventh-Grade Boys

PERCENTILE	AGES							
	10	*11*	*12*	*13*	*14*	*15*	*16*	*17*
High		34	30	33	30			
90		30.2	29.7	29.1	26.2			
80		26.7	26.8	26.8	24.8			
70		24.8	25	25.2	24			
60		23.6	24.3	23.6	22.4			
50	23.6	22.6	23.4	21.9	20.5	20.4	18.5	19.6
40		21.2	22.5	20.6	19.4			
30		19.4	21.5	19.6	18.7			
20		17.8	20.4	18.5	17.8			
10		12.8	19.1	16.4	16.1			
Low		10	13	11	11			
No. of Pupils	44	244	366	312	206	92	48	19

TABLE IIh

Seventh-Grade Girls

PERCENTILE	AGES							
	10	*11*	*12*	*13*	*14*	*15*	*16*	*17*
High		34	32	30	32			
90		29.7	28.3	27.2	27.5			
80		28.5	25.5	25.2	26			
70		25.5	23.4	23.2	24.4			
60		24.3	23.3	22.3	23.4			
50	25.1	22.9	21.5	21.4	22.5	17.1	17.3	17
40		21.9	20.5	19.9	19.3			
30		21.3	19.6	19.3	18.9			
20		20.3	17.3	18.5	17.1			
10		17.2	16.4	16.8	16.8			
Low		12	11	11	13			
No. of Pupils	81	335	596	240	159	48	27	13

TABLE IIi

Eighth-Grade Boys

PERCENTILE	AGES						
	11	*12*	*13*	*14*	*15*	*16*	*17*
High		33	34	33	33		
90		30.6	30.1	29.4	28.5		
80		29	29.1	28.2	26.2		
70		27.7	27.3	26.9	24.5		
60		26.9	25.4	25.7	23.2		
50	26.5	25.8	24.3	24.4	21.6	21.5	16.5
40		24.7	23.6	23	21		
30		23.8	22.7	22.3	20		
20		23	21.2	20.6	18.5		
10		21.6	20.1	18.8	17		
Low		13	13	11	12		
No. of Pupils	26	183	360	162	165	79	24

TABLE IIj

Eighth-Grade Girls

PERCENTILE	AGES						
	11	*12*	*13*	*14*	*15*	*16*	*17*
High		33	34	33	33		
90		29.8	29.1	27.3	29.6		
80		28.4	27.5	26	27.8		
70		26.1	26.4	24.9	24.4		
60		24.6	24.9	23.9	23.9		
50	26.5	23.5	24.2	22.8	22.3	20.5	20.6
40		22.7	23.4	21.9	21.4		
30		22	22.5	20.9	20.7		
20		20.9	21.5	19.5	19.8		
10		20.3	19.5	18.1	18.2		
Low		13	13	13	15		
No. of Pupils	41	208	391	233	154	61	20

TEACHING READING

THE EFFECT OF KNOWLEDGE OF RESULTS UPON ORAL AND SILENT READING

PANTHA VASHTI HARRELSON
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There seems to be a fairly universal agreement among students of the subject that silent reading is more efficient than oral reading. Most of the investigators have employed the test, teach, and retest method of studying the problem—that is, they have first given some standardized test and then have analyzed the results of the test to determine what the situation needed, and have applied remedial measures. Frequently these measures have covered long periods of time, in some cases a whole school year. Finally, they have given another form of the test, have compared the results obtained with those of the first test, and have measured the efficiency of the instruction offered between tests by the difference in their scores.

Miss Harriet O'Shea employed a slightly different method.[1] She had each student of a high-school group read some book of high literary value for a period of fifteen minutes a day and keep an accurate record of the number of lines read daily. When a given book was finished, she compared the achievement of the first two with the last two days, the difference between the two being taken as a measure of change in efficiency. On the whole, her results indicate rather large gains in rate; she made no study of comprehension. Probably the most significant thing in her work is the method that she employed. She attempted to find a measure of the efficiency of her subjects daily in terms of the material with which they were working. This keeping of records by the students themselves acted as a motivation factor from within. It had been wholly overlooked by most of the other investigators. Does such a procedure have any value? If so, could it be employed in comparing two methods of reading?

In order to make clear to students a method of measuring the results of teaching in terms of the materials being taught, the writer planned and directed the experiment reported in this paper.

Twenty-six young women worked on the problem: Which is the more efficient method of reading, the oral or the silent, when measured in comparable terms? They were members of the writer's class in Methods for Elementary Teachers in the Louisiana Normal College,

[1]Reported by Starch in his *Educational Psychology*, 1918.

Natchitoches, La. They were all in their fifth term of college. All work was done in the students' study rooms during the evening study hour. Little or no distraction was reported; and, indeed, little or none would be possible under the well-organized plan of study fostered in the college.

The directions under which the group worked were as follows:

1. Select from the class a partner with whom to work. Try to select some one that works as fast as you do, and you can compare your daily progress.
2. Arrange for a regular hour and place of reading that will be as free from distraction as possible.
3. Decide by chance which shall read orally the first day and which shall read silently. By alternating, each student will read every other day by the same method.
4. Read daily for a total of five minutes as follows:
(a) Let one student act as subject and the other as the experimenter—the former to read and the latter to keep the records.
(b) Let the experimenter note the time, tell the subject to get ready, and, when the second hand of her watch is on sixty seconds, tell the subject to "read." After thirty seconds have elapsed, tell the subject to "stop."
(c) Let the subject mark in her text the point reached and record immediately all that she remembers of what she has just read.
(d) Let the experimenter, while the subject is writing her report, count the number of words read by the subject, and enter them in a table and on a graph so that the subject may see just how much she reads each time.
(e) Let the subject notify the experimenter when she has completed her written report of materials read, and let them together repeat steps b, c, and d for ten consecutive trials. Each new trial begins at the point where the preceding one left off.
(f) Let the experimenter become subject, and the subject experimenter, when the ten readings for the first subject are complete, and repeat the whole process, using, of course, the method of reading not employed by the first subject.
(g) Let the student who was experimenter first to-day be subject first to-morrow.
5. Report to the instructor for further directions when you have read in the above fashion Chapter III in Kendall and Mirick, *How to Teach the Fundamental Subjects.*

When all students had reported the chapter read, they were instructed as follows:

1. Count the total number of ideas in your written report for each of the ten consecutive readings for every day read. Consider any noun, any noun phrase, any verb, or any verb phrase an idea. Enter these in tables, and graph as directed in 4d above.
2. Find averages and average deviations for each day and plot results for both rate and comprehension for each day. Compare your record in both rate and comprehension in the two methods.

It may appear that the period of thirty seconds was too short for an appreciable amount of reading. It seemed, however, desirable to make the period short enough so that only about an ordinary paragraph would be read at one time. This was easily possible even at the beginning of the experiment, when on an average 97.7 and 109.6 words per thirty seconds were read by the oral and silent methods, respectively. In addition, this was the length of time used by Starch in his reading test,[2] and a comparison of our results with his would be interesting, even though the materials are not strictly comparable.

Other units could have been taken as a measure of efficiency besides those used here—the number of words read, for rate, and the number of ideas reported, for comprehension—but these seemed best for the criteria employed. A repetition of the experiment, using other criteria or even reversing the conditions used here, would be instructive.

The two criteria kept in mind by the instructor were: first, that the reading should call out individual activity and the results themselves act as a stimulus to further activity on the part of the students; and, second, that the records should be objective.

Both of these seem to be fairly well met. The counting and plotting of the student's record as it was being made was a constant stimulus to her to put forth her best effort in order to equal or to surpass her previous record and, if possible, to keep up with or go ahead of her working partner. At the same time there was little chance of discouragement. In cases where a student made a poor record she soon learned that the next one would probably be better. Some of the girls sought definitely to lead the class and to maintain their leadership. But this was true only for rate of reading. There was no such rivalry in recording the number of ideas read. The students did not know what use was to be made of the written report. They had simply been told to make it, and did so.

No subjectivity was possible in counting the number of words read or of ideas reported. These were simple units easily understood and accurately counted. In the matter of timing there is some possibility of error; but such error, if it existed, would be constant for both methods, since all students alike were unschooled in the matter of making time records other than those in ordinary life situations.

The data in Tables I and II were calculated on the basis of the record of 23 students for 10 days' work.[3] Only the first 10 days are reported, as 12 of the subjects had completed reading the chapter in

[2]Starch, D.: "The Measure of Efficiency in Reading." *Journal of Educational Psychology*, 1915, VI, 1-24.

[3]Three records were discarded—one on account of the student's illness and the other two on account of students' misconstruing the directions given.

this time. Obviously, averages for readings beyond this time would not be representative when they would not include work of the better half of the class. Then, too, there were some students who finished in 10½, 11, or 11½ days. We deemed it better, therefore, to consider only the first 10-days' work, giving thereby an equal time limit to the two methods.

The 10 readings for a given day for each of the 23 subjects are included in a single distribution table, giving a total of 230 readings per day for each of the 10 days—5 days in silent and 5 days in oral reading. The frequency tables manifested much the same form for both rate and comprehension, being in all cases slightly skewed toward the lower end of the range. We used, therefore, the average as the more representative central tendency of the group.

TABLE I

Achievement in Rate, by Days

Day	No. of Words Read: Oral Ave.	Oral P.E.	Silent Ave.	Silent P.E.	Difference S-O	P.E. of Diff.	Ratio of O to S	% Gain of Each Day Over First: Oral	Silent
1	97.7	15.9	109.6	18.5	11.9	1.6	.891		
2	106.5	18.9	121.4	19.7	14.9	1.8	.889	9.0	10.8
3	117.4	21.9	134.1	24.1	16.7	2.2	.875	20.2	22.4
4	127.1	21.7	144.6	24.0	17.5	2.1	.888	30.1	31.9
5	135.0	27.5	151.4	30.8	16.5	2.5	.891	38.1	38.9

TABLE II

Achievement in Comprehension, by Days

Day	No. of Ideas Reported: Oral Ave.	Oral P.E.	Silent Ave.	Silent P.E.	Difference S-O	P.E. of Diff.	Ratio of O to S	Ratio of Compr. to Rate: Oral	Silent
1	16.8	6.2	19.4	6.0	2.6	0.54	.865	.171	.177
2	19.4	6.3	20.9	7.0	2.1	0.61	.899	.176	.173
3	20.7	8.7	24.3	9.2	3.6	0.81	.852	.180	.181
4	23.1	9.7	25.2	10.2	2.6	1.01	.897	.173	.174
5	26.8	12.2	28.7	11.5	7.9	1.42	.934	.198	.190

Tables I and II indicate the results achieved in each of the two methods for rate and comprehension. They are to be read as follows: On the first day, according to Table I, the average number of words read was 97.7 by the oral method and 109.6 by the silent method, giving a difference of 11.9 ± 1.6 ideas in favor of the silent method. The ratio between the average number of words read by the two methods is .891, showing that in the beginning approximately 89 per

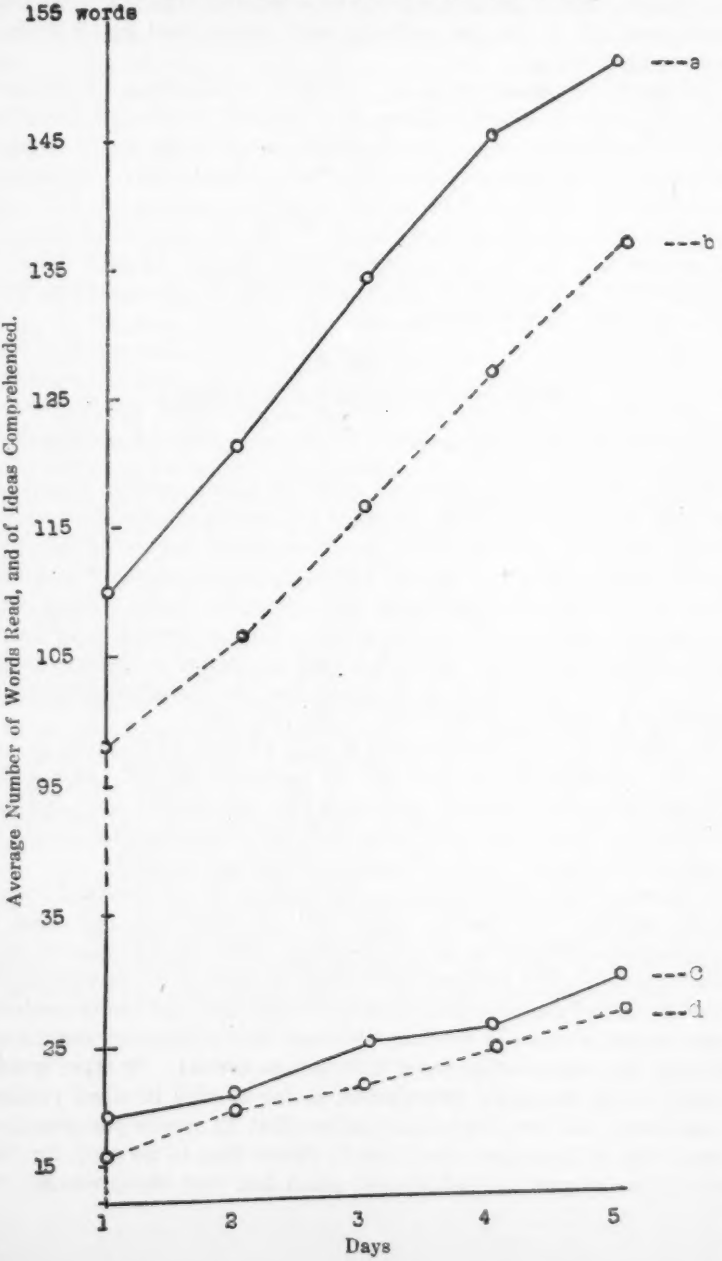
cent as many words were read by the oral as by the silent method. The gain of the second day over the first for the two methods is 9 per cent for the oral and 10.8 per cent for the silent, again showing a slight superiority in favor of the silent method. In like manner, Table II shows that the average number of ideas comprehended on the first day was 16.8 by the oral method and 19.4 by the silent method, giving a difference of 2.6 ± 0.54 ideas in favor of the silent method. The ratio between the averages of the two methods is .865, or approximately only 87 per cent as many ideas comprehended by the oral method as by the silent method. The percentage of ideas comprehended to ideas read by the two methods is, however, seen to be practically identical—that is, .171 for oral and .177 for silent.

Following the results through the consecutive days, we find continuous, practically constant, and rather large increases in the average number of words read by both methods. There is only a small difference in percentage increase between the two methods, but in every case it is in favor of the silent method. On the third day it amounts to 2.2 per cent, but on each of the others it is only 1.8 per cent. The fact that it continuously favors the silent method gives it some significance.

A similar increase is seen in the number of ideas reported. But here an additional factor must be considered. Is the increase actual, or is it merely the result of the increased amount of material covered on the successive days? From the ratio between rate and comprehension by days, the latter seems to be the case. For both methods, this ratio remains practically constant for each of the five days. Furthermore, in each pair of scores for any day the ratios are practically identical for the two methods. There are small fluctuations above and below the ratio for the first day, but they are not constant in favor of either method—that is, for a given quantity of material read, whether orally or silently, an equal number of ideas was comprehended, under the conditions of this experiment.

This failure to increase in ability to comprehend is brought out strikingly in the curves based on the average daily achievement in Figure I, as is also the fact that the silent method of reading was the more efficient in the beginning of the experiment, and constantly maintained its superiority. In addition, these curves seem to indicate that the class, as a whole, had not yet reached the limit of ability to improve, either in rate or in comprehension, by either method, despite the fact that an average per minute of 303 words and 270 words, respectively, were being read by the silent and the oral methods. It

FIGURE 1. Achievement—(a) Rate by the silent method and (b) Rate by the oral method; (c) Ideas from silent reading and (d) Ideas from oral reading.



will be recalled that the comprehension of the class at the end of the experiment was of equal proportion to what it was when only 219 words and 185 words, respectively, were being read per minute by the two methods.

Reference was made above to a study in which Starch established norms for rate in silent reading from results in actual grade situations in the public schools. Table III shows his norms for the average number of words read per second in grades 4-8, inclusive. If these be converted into averages per period of thirty seconds, the time employed in his test, the norm would be 72, 84, 96, 108, and 120 words for grades 4, 5, 6, 7, and 8, respectively—that is, he establishes 12 words as the normal rate of increase per year for these grades, using only a period of thirty seconds.

TABLE III

Norms in Rate of Silent Reading (Starch)

Grade	4	5	6	7	8
Speed of Reading (words per second)	2.4	2.8	3.2	3.6	4.0

If now we compare our results with his silent reading norms, we find that orally our subjects achieved only the sixth-grade norm and silently only the seventh-grade norm, provided the materials read were of equal difficulty. In our judgment, the exposition read by the young women in this experiment was somewhat more difficult than the material presented in Starch's test. This is merely a judgment, however, and additional research would be needed to determine the point. For the time being let us grant that the materials are equally difficult and compare achievement in the two cases.

By reference to Table I we find a total gain of 37.3 words in oral and 41.8 words in silent reading. In terms of Starch's norms this achievement would normally require 3.19 years on the one hand and 3.48 years on the other. Probably only our silent reading should be compared, however, if any comparison at all can be made.

To pursue this line of thought a bit further, let us assume, in addition to equality of material, that these young women are equal to seventh-grade children in skill in reading. This would mean, if they read normally in the seventh grade, that in their four years of high-school work and the first two years of college they had really made no improvement in speed in reading, although they commonly complained that they had been overburdened with things to read. In other words, it would mean six years' retardation, so far as skill in silent reading is concerned. If now we argue further that 12 words per year is a normal rate of increase—and Starch shows this to be true for five years of the elementary school—we shall find that these women, re-

tarded six years in skill in reading, have overcome during ten days of motivated practice 3.48 years of this retardation. Actually they read only five days by the silent method, but even at the longer time this gain is remarkable in comparison with the normally expected gain. It is to be expected also that there was considerable transfer from silent to oral reading, and vice versa; but this problem, as are others raised in this paper, is of sufficient importance to require separate treatment. The problem of the permanency of the improvement here noted surely needs investigation.

This experiment seems to support the general thesis that silent reading is more efficient than oral reading, although further study is needed to determine this point certainly from the standpoint of learning. It indicates, further, that comprehension is proportional to rate, although our results show no actual increase in skill in comprehension. Perhaps the most important indication is the factor which is responsible for the difference in increase in rate and increase in comprehension—namely, the method. This method of showing in a definite and systematic, yet simple, way just what a student is achieving is of very great importance. It acts as a stimulus to increased activity, but also prevents the discouragement that normally results from differences in achievement in a group. The student is constantly working against his own record as well as against the record of others to whose endowment his own may in no wise be equal.

Finally, the experiment raises a number of problems that would be both interesting and profitable for study. In other places we have mentioned these, but it may be well to recount them here. Under reversed conditions, would the results of this experiment be the reverse of those here presented? Does transfer from one method to the other modify the results reported in this paper? Could other types of school activity be evaluated under some such method as that employed here? Would other criteria permit equal or better results if they were used in a study of this sort? Would a longer period of time daily, as well as for the entire experiment, change significantly these results? Would less mature, but equally retarded, pupils show an equal gain? These and other problems occur to the writer as being of much worth to the student of method as it affects classroom practice.

EDU. Curr.
PHYSICS

STARTING THE SMALL PHYSICS LABORATORY

HANOR A. WEBB
George Peabody College for Teachers

"Unsought advice, like bad food, is rarely palatable; but to be polite thou must urge good food or sought advice upon a guest in a greater measure than perhaps he needs."

A LETTER

". . . I have just graduated from the university, and in my new position I am to be principal of a school and teach mathematics and whatever science is offered. I am wondering whether to attempt physics, since they have no laboratory equipment and there is no likelihood of a worth-while appropriation. Under the circumstances, would you advise me to offer physics?

"Sincerely yours,
"----------"

THE ANSWER

. . . The days of old, when lamps were rubbed, wands waved, or formulas uttered to bring things springing into complete existence, must have been wonderful for physics teachers. If palaces could be built by this magic, why not laboratories? Unconsciously, you have harbored such a conception of the laboratory, for in the university you waved a magic card with your name on it, and apparatus came forth from a seemingly inexhaustible store. Bottles which you emptied were mysteriously full the next hour; you were as comfortable as the widow of Zarephath, whose barrel of meal wasted not and whose cruse of oil did not fail. Like Philemon and Baucis, whose pitcher of milk ever flowed, you hardly knew whom to thank for the supply.

You now realize with a shock that laboratories do not happen; they grow. Your letter shows that you are fully aware of the foolishness of trying to teach physics without experiments. *No laboratory, no physics,* is your slogan. May I offer some suggestions for the planting and early cultivation of a young physics laboratory?

THE SPIRIT OF THE WORK

Let us start the cultivation with yourself. There is a science of teaching science. Send ten cents to the Superintendent of Documents at Washington for a copy of *"Reorganization of Science in Secondary Schools," Bureau of Education Bulletin, No. 26, 1920.* Caldwell (Lincoln School, New York) led a group of fifty science teachers to a harmonious expression of the why, what, and how of high-school science.

Two other books will help you to the spirit of teaching: *"The Principles of Science Teaching," by Twiss,* of Ohio State University (Macmillan Company), and *"The Teaching of Physics," by Mann,* now consulting expert of the War Department (Macmillan Company). Knowing physics does not necessarily mean knowing how to teach physics; you will need a teaching attitude as well as a scientific attitude. These books have helped many into the spirit of the work.

Subscribe at once to *School Science and Mathematics,* 2059 East 72 Place, Chicago (nine issues per year, $2.50). This is the best magazine on teachers' problems and methods in science and mathematics. Subscribe also to *The Monthly Guide for Science Teachers,* Modern Publishing Company, 225 West Thirty-Ninth Street, New York (nine issues per year, 25 cents). This publication is most prolific in suggestions for making apparatus, selecting books, organizing science clubs, and stimulating interest in every way. Write to *The Popular Science Monthly,* New York, for a sample copy of their magazine and special rates to schools.

FIRST THINGS FIRST

What is needed for the laboratory? Starting with nothing, you are going to equip it from three principal sources:

First, you and the students will make out of simple materials most of the things you *must* have.

Second, you will beg or borrow many things from homes and stores of your community.

Third, as you prosper, you will buy.

Most important are simple things for the pupils to work with. Next in urgency are simple things for the teacher to demonstrate with. Then come those standard manufactured articles, which must be specially designed, to teach the laws of physics. Last—and possibly never, in your elementary laboratory—the big, expensive, showy things which may be used only by the teacher, and then but once a year. I have seen more than one physics laboratory possessing a great Wimshurst static machine, but no magnets for the boys and girls to use; or an expensive spectroscope, but not a single small lens

with which really to study light. After all, you will be working with children; so do not be ashamed of a type of childishness in the laboratory articles. A "Little Hustler" toy motor will teach real principles; toy engines, though undignified, really show how steam is put to work. The man who invents a plaything is a human benefactor; he who designs a laboratory toy is the teacher's best friend.

THE THINGS YOU MAKE

There are certain values to both student and teacher in making a piece of equipment. Always better than nothing, it is often better than anything else. The necessity is at least a threefold blessing:

First, it develops resourcefulness. Inventors are improvisors.

Second, it teaches the principles of physics. Users may, makers must, understand.

Third, it calls attention to science that is close to life. In a modern home every large principle of physics is operating somewhere, often wholly unperceived.

Now send for some helpful books: *Good, "Laboratory Projects in Physics"* (Macmillan Company); *Woodhull, "Homemade Apparatus"* (A. S. Barnes Company, New York). Borrow from a library *Victor Hugo's "Toilers of the Sea,"* and read in the Second Part the triumph of a resourceful man. Resolve with Gilliatt that if you cannot accomplish a result in one way you will in another. The amount of apparatus which you and your pupils actually make is to be one test of your energy and resourcefulness.

THE THINGS YOU BUY

Catalogs may be used for two purposes: to suggest worth-while apparatus that may be made or borrowed, and to serve as a buying guide. Secure the general catalogs of Sears, Roebuck & Co. and Montgomery, Ward & Co., Chicago, mail-order houses, and of A. C. Gilbert & Co., New Haven, Conn., manufacturers of toy sets. Then write for catalogs of any two of the following firms:

Cambridge Botanical Supply Company, Cambridge, Mass.

Central Scientific Company (Catalog F), 460 East Ohio Street, Chicago.

Chicago Apparatus Company, 701 West Washington Boulevard, Chicago.

William Gaertner Company, 5345 Lake Park Avenue, Chicago.

L. E. Knott Apparatus Company (Catalog 26), Boston.

Schaar & Co., 556 West Jackson Boulevard, Chicago.
Standard Scientific Company, 147 Waverly Place, New York.
C. H. Stoelting Company, 3047 Carroll Avenue, Chicago.
W. M. Welch Scientific Company (Catalog G), 1516 Orleans Street, Chicago.

There are certain items that cannot be improvised; they must be purchased. It is an advantage to get many of them locally, especially if they are objects of a strictly practical use. Most electrical equipment, for example, should be of the commercial kind. Loans and gifts of such material to the school should be earnestly sought.

Then there are types of apparatus, manufactured by the companies listed above, which are specially designed to teach the laws of physics. A number of these are almost indispensable; but let me remind you again that things for the student to work with are the first things needed.

AS YOU PROSPER

The laboratory, of course, must not degenerate into a curio shop of roughly made toys. To students who are already receiving the benefits of personally planning and constructing apparatus, the contact with more finely finished equipment offers certain advantages. First, it sets standards of workmanship; second, it creates a respect for accuracy; third, it presents certain phenomena for which the more intricate apparatus is indispensable; you cannot improvise an X-ray tube.

Plan each year, or every alternate year, to secure *one* useful piece of the more expensive physical apparatus. They are not the foundation of your course, but, wisely selected, they are ornaments to it. They increase interest and create a respect for the science. They will stimulate your own enthusiasm, perhaps, and they will impress your visitors. But they should come last, not first.

A LIST OF EQUIPMENT

The following list is neither the largest nor the smallest beginning for a laboratory. It is quite modest as to money expense, but with these things you could keep a class thoroughly busy. The items marked with a * are for demonstration purposes, and one article is usually sufficient. Other items are for students' experiments; and, as a rule, there should be one article for each two students. By proper assignment of problems in the laboratory, however, one piece of apparatus will serve several pairs of students in succession.

Tools and Measurements

Improvise

Liter block
Stands of all kinds

Secure locally

Files, round and triangular
Glue pot and brush
Metal shears
Pliers and shears
Screw hooks and eyes
Thumb tacks
Glass cutter
Metal saw
Pencil compasses
Plumb bobs
Soldering set
Woodworking tools

Purchase from supply house

Cross-section paper
Meter sticks
Protractors, cardboard
Double calipers
Metric rules, 12-inch
*Vernier caliper

Add, as soon as practicable

*Micrometer caliper
*Reading telescope
*Wire gauge
*Micrometer screw
*Slide rule

Properties of Matter

Improvise

Adhesion discs
Geometrical shapes of wood
Capillary plates
Wire forms for liquid films

Purchase from supply house

Prince Rupert drops
Set of capillary tubes

Mechanics of Solids

Improvise

Center of gravity toys
Collision balls
Inclined plane and car
Pendulums, harmonic
Rotator and attachments
Centrifugal machine
Composition of force board
Levers, all kinds
Pendulums, simple
Wheel and axle

Secure locally

Automobile jack
Marbles, clay and glass
Rubber balls
Automobile parts
Pulleys, commercial types
Wheels, geared (use old clock)

Purchase from supply house

Balances, hand
Balls, cast iron, with hooks
*Gyroscope, simple toy
*Pulley, for inclined plane
Weights, metric, set .001 to 50 gm.
Balances, spring, Eng. and metric scales
Pulleys, small, single, double, triple
Weights, 1 to 1000 gm.

Add, as soon as practicable

*Atwood acceleration apparatus
Balances, laboratory type
*Rotator and attachments
*Balance, Jolly
*Metronome
*Stop watch

Mechanics of Fluids

Improvise

Balancing columns
*Bottle imp
Hydrometer jars
*Barometer
Equilibrium tubes
Osmosis apparatus

Overflow cans
Siphons
Specific gravity specimens
Pressure gauge, glass
*Special hydrometers
*Water-wheel models

Secure locally

Bottles of all kinds
Cork stoppers

Purchase from supply house

Glass tubing, 3/16-inch outside diameter, 5 lb.
Graduates, 100 ml. (cc.)
*Hydrometer, light liquids
Mercury, 1 lb.
Rubber tubing, ¼-inch bore, 6 ft.
Glass tubing, ¼-inch outside diameter, 3 lb.
*Hydrometer, heavy liquids
Hydrometer tubes, for shot
Rubber tubing, 3/16-inch bore, 12 ft.

Add, as soon as practicable

*Barometer, aneroid
*Boyle's law apparatus
*Barometer, mercury type
*Pumps, glass models

Pneumatics

Improvise

*"Upward-pressure" apparatus
*Vacuum gauge of glass

Secure locally

*Air gun
*Bicycle pump

Purchase from supply house

*Bell jar, open top
*Vacuum plate
*Stop cocks
*Vacuum and pressure pump, bicycle pump style

Add, as soon as practicable

*Air pump and accessories
*Foot blower
*"Seven-in-one" apparatus
*Coin and feather tube
*Oil vacuum pump
*Water hammer

Heat

Improvise

Air thermometer
*Compound bar
*Convection apparatus
*Fireless cooker
Specific heat apparatus
*Ventilation apparatus
Calorimeters
*Conductimeter
Dew point apparatus
Linear expansion apparatus
Steam boilers
Wet and dry bulb thermometers

Secure locally

*Electric heating appliances
Lead shot
*Toy steam engine
Glass beads
*Thermos bottle

Purchase from supply house

Alcohol lamps or burners
Thermometers, centigrade
Balls or shot of aluminum, copper iron, lead

Add, as soon as practicable

*Ball and ring
Calorimeters
*Critical tube
*Linear expansion apparatus
*Palm glass
*Steam engine model
*Blast lamp, alcohol or gasoline
*Charles' law tube
*Fire syringe
*Mechanical equivalent of heat tube
*Radiometer
*Thermo-couple

SOUND

Improvise

- Acoustic tube
- Resonance boxes
- Resonance tubes
- *Siren disc
- Cork hammer
- Resonance pendulums
- Rope, strings, wires
- *Sonometer

Secure locally

- *Phonograph, small
- *Violin bow
- *Stethoscope, doctor's
- Whistles, bells, etc.

Purchase from supply house

- *Interference tube
- *Spring, long spiral
- Tuning forks, unmounted, pitch C, C-1, E-1, G-1, C-2
- Pitch pipes
- Tuning fork, adjustable

Add, as soon as practicable

- *Chladni plates and holder
- *Siren disc, three-in-one
- *Sympathetic forks
- *Xylophone, or toy "orchestra bells"
- *Manometric flame and mirror
- *Sonometer
- *Vibrograph

LIGHT

Improvise

- Color tops and discs
- Optical bench and attachments
- Photometer and screen
- Interference rings apparatus
- Pinhole cameras
- Refraction of liquids apparatus

Secure locally

- Candles and lamps
- *Reading lens, large
- *Toy magic lantern and slides
- Plane mirrors
- *Stereoscope
- *Toy telescope

Purchase from supply house

- Glass plates, seven colors
- Kaleidoscope
- Mirrors, concave and convex
- Prism, flint glass, 45° and 90°
- *Iceland spar, for double refraction
- Lenses, six forms
- Prism, flint glass, equilateral
- Refraction plates

Add, as soon as practicable

- *Diffraction grating
- *Polariscope, simple
- *Spectroscope, direct vision
- *Optical disc and attachments
- *Post card projector
- *Tourmaline tongs

MAGNETISM

Improvise

- Dipping needle
- Polarity rods
- Electromagnets
- Solenoids

Secure locally

- Blue-print paper
- Wire, annunciator, or "bell"
- Large knitting needles
- Tacks, nails, etc.

Purchase from supply house

- Compasses, small
- Magnets, bar type
- *Natural lodestone
- Iron filings, or powder
- Magnets, horseshoe type

Static Electricity

Improvise

- Condenser plates
- Electrophorus
- Electric plumes, paper
- Induction cylinders
- *Leyden jar, large
- Pith balls, corn pith
- *Egg, covered with tin foil
- Electroscopes, gold leaf
- Friction rods, glass, rubber, wax
- Leyden discharger
- Leyden jars, small
- Proof planes

Secure locally

- Cloth—woolen, silk
- Fur, such as catskin

Purchase from supply house

- Gold leaf
- Tin foil

Add, as soon as practicable

- Leyden jars, students' removable type
- *Vacuum and Geissler tubes
- *Static machine
- *X-ray tube and fluoroscope

Current Electricity

Improvise

- Cells, simple voltaic
- *Electrolysis outfit
- *Plating outfit
- *Rectifier, chemical type
- Shunts
- Contacts and binding posts
- Galvanometers, simple
- Primary and secondary coils
- Resistance coils
- Wheatstone bridge

Secure locally

- Auto-electric equipment
- Dry cells
- Friction tape
- Incandescent bulbs, 110 v.
- Plugs and sockets
- Transformers, small 110-6 v.
- Batteries, commercial types
- Electric bells
- Incandescent bulbs, auto, 6-12 v.
- Induction coils, Ford type
- Push buttons
- Wire, insulated copper, No. 18, No. 30

Purchase from supply house

- Telephone outfit (Sears, Roebuck)
- Motors, "Little Hustler"
- Wire, German silver, insulated, No. 18, No. 30

Add, as soon as practicable

- Binding posts and connectors
- Daniel or gravity cells, with chemicals
- *Galvanometer, D'Arsonval or tangent
- Knife switches, single and double
- Metallic electrode elements of aluminum, carbon, copper, iron, lead, nickel, tin, zinc
- Pole changer, or commutator
- *Rectifier, Tungar bulb
- Resistance spools, standard set
- *Telegraph relay
- *Volt-ammeter
- Contact keys
- *Dynamo, hand power
- Induction coils, demonstration form
- *Magneto generator
- *Plunge battery
- Porous cups, small
- Resistance boxes, .1 to 40 ohms
- *Telegraph key and sounder
- *Transformer, step-down
- Wireless, student's outfit

BOOKS IN THE LABORATORY

"Looking up" something in a reference book should not be a matter of special assignment; it should be a habit. Certain books should

stand on a shelf or table in the laboratory, for the quickest reference service is the best. There should be a large college physics text; *Kimball's "College Physics"* (Henry Holt & Co., New York) will serve as a compendium of information for practically all questions. There may be several high-school physics texts, from which the different angles of approach to a problem may be observed. For practical suggestions a most suitable book is *Lynde, "Physics of the Household"* (Macmillan Company). *Hodgman, "Handbook of Chemistry and Physics"* (The Chemical Rubber Company, Cleveland, Ohio), contains all necessary data, tables, etc. *Cajori, "A History of Physics"* (Macmillan Company), links the early experiments with the present ones and adds human interest to the work. Of course there must be various other books, and magazines as well, in the school library for the use of the physics students. This, however, must be the subject of another letter.

I hope that this will help you to decide that the physics laboratory shall be started. "Eventually, why not now?"

Geo. Ancient

THE STATUS OF GEOGRAPHICAL KNOWLEDGE UP TO THE TIME OF AUGUSTUS

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The beginning of geography, like that of some other scientific subjects, is more or less shrouded in mystery.[1] Perhaps it first originated with the Chinese, then came by the way of India and Babylonia to Egypt, and from there to the Greeks and Romans.[2]

The Græco-Roman civilization was the center of exploration which has revealed the world and has rendered possible the present world-wide civilization.[3]

It is true that the Phœnicians were the first nation of discoverers of whom there is a definite record.[4] Their ships sailed in all the Mediterranean waters and in those of the Black Sea. They discovered Spain about 1050 B.C.,[5] and brought from there many of the metals and native products. As early as 1000 B.C. traders came to them from India and from lands beyond the Red Sea.[6] Both Hebrew and Greek literature represent them as daring navigators capable of conducting long voyages and bringing back the products of distant countries.[7] Tyre, one of the principal Phœnician cities, is mentioned in the Bible as "a mart of the nations."[8]

By the time of Herodotus (484-424 B.C.) the Phœnicians had established colonies on the northwest coast of Africa, had brought tin from Cornwall, and had made valuable contributions to the exact knowledge of geography by their travels. They sailed to the Malabar coast of India and to "Ultima Thule." Some historians claim that this latter region is what is now known as the Shetland Islands;[9] others suggest that Iceland might have been meant;[10] and yet others think that it might have been the southern coast of Norway.[11]

In all these explorations the Phœnicians were strictly a commercial people. They had only the desire for personal or national gain.[12]

[1]Williams: "A History of Science," p. 1.
[2]Bill: "A General View of the World," p. 9.
[3]Mill: "International Geography," p. 7.
[4]The New International Encyclopedia: "Geography."
[5]Gibbins: "The History of Commerce in Europe," p. 9.
[6]Mitchell: "Ancient Geography," p. 9.
[7]Bunbury: "A History of Ancient Geography," Vol. I, p. 4.
[8]Isaiah, XXXII, 3.
[9]Ency. Brit., Ninth Edition: "Geography."
[10]Willard: "Ancient Geography," p. 10.
[11]Mitchell: "Ancient Geography," p. 9.
[12]New International Encyclopedia: "Geography."

Even the inventions popularly attributed to them by the ancients—i. e., shipbuilding, arithmetic, the famous purple dyes, glass manufacture, and the coinage of money—tend to prove this to be a fact.[13] While the modern world is inclined to doubt that the Phœnicians invented any of the arts and industries, yet it cannot be denied that they developed them with singular skill and widely disseminated their knowledge and use.[14]

The Phœnicians knew the western part of the then known world, but would not give this information to others, because it would have led to commercial competition. Had the power remained with them, the result of all these explorations might have been lost to history. This power, however, did not remain an undisputed possession of the Phœnicians. In the very height of their commercial prosperity the Greeks began to contest with them for the supremacy of the Mediterranean.[15]

The contrast between these two nations is great. The Phœnicians were strictly commercial; the Greeks sought the beautiful in art and literature. The Phœnicians left no written record of their activities; the Greeks spread their culture throughout the Mediterranean countries and left to history the written records not only of their own civilization, but also of that of the surrounding nations. Both were powerful in their own peculiar way; and while much honor is due the Phœnicians for their great geographical discoveries, yet perhaps more is due the Greeks for handing down these discoveries to posterity in the form of history. The earliest history of Europe is by Greek writers, and from this center geographical knowledge was extended to the west and north of the continent.[16] The Greek became the teacher of the whole world,[17] and thus the intellectual supremacy of Greece became the foundation of modern civilization.[18] The limited area of this country caused an early dissemination of her people over the Mediterranean basin, thus widely distributing her culture and knowledge. Commerce and colonization were the vehicles of this civilization,[19] which added much to the geographical knowledge of the world, both by means of exploration and by the recording of facts thus learned.

The famous poet, Homer, so excelled all, both ancient and modern, in the sublimity of his poetry and in his experience of life, and so exerted himself to become familiar with the facts of natural history and to transmit them to posterity, that Strabo calls him the "founder

[13]Putz: "A Manual of Ancient Geography and History" (translated by T. C. Arnold), p. 64.
[14]Ency. Brit.: "Phœnicia."
[15]Anthon: "A System of Ancient and Medieval Geography," p. 4.
Jacobs: "The Story of Geographical Discovery," p. 18.
[16]Anthon: "A System of Ancient and Medieval Geography," p. 4.
[17]Guyot: "The Earth and Man," p. 308.
[18]Mill: "International Geography," p. 346.
[19]Semple: "Influence of Geographic Environment," p. 192.

of geographical science."[20] The catalog given in the second book of the Iliad is a map of Greece of that time.[21] It is a geographical document, the poetic but not untrue painting of a certain Mediterranean, with its habits of navigation, its theories of naval life, its language, its nautical instructions, and its commerce.[22]

This early period was one of myth and legend, as well as of proven fact; but "man is eager after knowledge, and the love of legend is but the prelude thereto."[23] Geographical knowledge at this time was almost confined to the eastern Mediterranean, bounded by Phœnicia and Egypt, which were known by name.[24] Homer's world was Greece and the Ægean Sea, though he knew some of the leading features of Africa and had heard of Egypt and the Nile, of the Pygmies, of the Ethiopians, and of South Italy.[25] To him the world was a flat, round disk floating in the ocean. Near the center of this disk and grouped around the Mediterranean were Egypt, Greece, and Phœnicia. These were surrounded by the deep, flowing river, Oceanus, in which were Elysium, Ethiopia, the Fortunate Isles, and the land of the Hyperboreans. Beyond Oceanus was the "Terra Incognita."[26]

From this mixture of truth and error modern geography has retained the one idea that a great sea surrounds the land.[27]

Strabo (64 B.C. to 19 A.D.) makes the statement that there were more than fifty Greek writers on the subject of geography. Among these he mentions Homer, Anaximander the Milesian, Hecatæus, Eudoxus, Eratosthenes, and many others.[28] The writings of some of these have been preserved.

Herodotus (484 to 424 B.C.), the historian, is another source of knowledge of ancient geography. In addition to oral information, he seems to have drawn largely from the Persian archives.[29] He also traveled extensively over Greece, Macedonia, Thrace, Asia, Egypt, and Lydia, and incorporated the geographical knowledge thus gained into chapters of his "History of the Persian Wars."[30] He studied geography to illustrate his histories, and collected, arranged, and summarized the discoveries of his predecessors.[31] He tells the story of the circumnavigation of Africa by a fleet sent out by Necho, king of Egypt. They set out by way of the Red Sea and sailed until au-

[20] Strabo: "Geography" (translated by Falconer & Hamilton), Book I, Ch. I, 2.
[21] Freeman: "A Historical Geography of Europe," p. 26.
[22] Brunhes: "Human Geography," p. 584.
[23] Strabo: Book I, Ch. II, 8.
[24] Tozer: "Classical Geography," p. 5.
[25] Anthon: "A System of Ancient and Medieval Geography," p. 4.
Bunbury: "History of Ancient Geography," Vol. I, p. 40.
[26] F. A. Ogg: "Geography from Homer to Columbus," Chautauquan, Vol. 32, p. 473.
[27] S. Walpole: "The Growth of the World," Cont. Review, Vol. 93, pp. 171-178.
[28] Strabo: "Geography" (translated by Falconer & Hamilton), Book I, Ch. I, 1.
[29] Putz: "Manual of Ancient Geography and History" (translated by T. C. Arnold), p. 6.
[30] Putz: "Manual of Ancient Geography and History" (translated by T. C. Arnold), p. 68.
[31] Bill: "A General View of the World," p. 9.

tumn, when they sowed corn and waited for it to ripen. After harvesting the crop, they again set sail. In this way two years were consumed, and in the third they turned the Pillars of Hercules and returned to Egypt.[32] Whether the story is true or not, the men who wrote it surely had a shrewd idea that it was possible. Eratosthenes (296 to 196 B.C.), the geographer and librarian at Alexandria, also considered Africa as being circumnavigable.[33]

It is known that Hanno sailed southward along the coast of Africa probably as far as the equator and established a colony somewhere near the present-day Sierre Leone.[34]

Expeditions of Alexander the Great (356 to 323 B.C.) and of Xenophon (born 430 B.C.) gave size and precision to men's ideas of the East. Grecian colonies had been settled on the Euxine and the Mediterranean Seas, in southern Italy and Sicily, also in southern France and in Spain. While Alexander did not extend the limits of geographical knowledge very much, yet he gave additional information about the countries of the East that had already been discovered.[35] His general, Nearchus, made an exceptional report on his voyage from the Indus to the Euphrates River.[36] Alexander's other generals—Seleucus, Antiochus, and Ptolemy—extended geographical knowledge in several directions. Seleucus established the Græco-Bactrian Empire and kept in touch with India. His ambassador, Megasthenes, gave the most authentic knowledge to be had at that time of the valley of the Ganges.[37]

This was one of the epochs of geographical discovery, and opened connection between the Grecian and the Hindu civilizations. The Greeks carefully described the towns, villages, products, and appearance of the country. Alexander's generals continued to extend this geographical knowledge.[38]

As the glory of Greece and the surrounding countries began to fade, a new nation which was to become the ruler of the whole known world was coming into power in the Mediterranean lands.[39] Rome continued increasing and unifying her geographical knowledge, and brought Britain, Germany, and many other border regions into the circle of civilization.[40] She was not much interested in discovery itself, yet her luxurious living demanded products from all parts of the known

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[32]Herodotus: IV, 42.
George A. Jackson: "The Beginning of Geographical Science," Popular Science Monthly, Vol. XVI, p. 236.
[33]Ibid.
[34]S. Walpole: "The Growth of the World," Cont. Review, Vol. 93, pp. 171-178.
[35]Harper's Classical Dictionary: "Geographia."
[36]Ibid.
[37]Ency. Brit., Ninth Edition: "Geography."
Bunbury: "History of Ancient Geography," Vol. I, p. 558.
[38]Ency. Brit.: "Geography."
[39]Williams: "History of Science," p. 253.
[40]New International Encyclopedia: "Geography."

world, and her military genius caused her to penetrate almost every country.[41] Before the Romans went to a new region to extend the limits of the empire they sent out expeditions to report the nature of the country.[42]

Rome explored all the coasts of the Mediterranean; in Europe she knew Italy, Greece, the Balkan Peninsula, Spain, Gaul, western Germany, and Britain; in Africa she was acquainted with Egypt, Carthage, Numidia, and Mauretania; in Asia she had traversed Asía Minor, Syria, Arabia, Persia, Scythia, Bactria, and India. The Roman intercourse with India especially led to an extension of geographical knowledge.[43]

Rome also opened up western Europe and northern Africa to the Greek scientists. In fact, Rome conquered by arms, but Greece by her genius reigned over her conquerors.[44] Thus the spread of the empire extended geographical knowledge regarding the north and west of Europe.[45] Strabo gave a detailed account of a large part of the world and fixed the boundaries of the great continents—Europe, Asia, and Africa—much as they are now known.[46]

Not only did warfare and luxury stimulate the Romans to visit other lands, but persons of leisure and wealth traveled extensively for pleasure and as a means of education and culture. The young men of aristocratic families went to Athens or to Rhodes to complete their education. Strabo, to gain accurate geographical information, journeyed from the Black Sea to Ethiopia and from Armenia to Italy.[47] People of wealth would take pleasure trips to Greece, thence to Asia Minor, and to Egypt on the corn vessels. Those interested in history and legend would make pilgrimages to ancient Troy.[48] The educated Roman also had reason to become acquainted with the comparatively civilized Celts who lived in Gaul and with the troublesome and migratory Teutons. The campaigns of Julius Cæsar made all Gaul and southern Britain familiar to the average Roman.[49] Lack of post offices and the modern press made travel a necessity for the ancient Romans.[50]

Thus it is evident that the Greeks and Romans knew only three divisions of the world—Europe, Asia, and Africa—and that their knowledge of extreme northern Europe and Asia and of southern

[41] Ency. Brit.: "Geography."
[42] Cæsar: "De Bello Gallico," Book IV, Chap. 21.
[43] Ency. Brit., Ninth Edition: "Geography."
[44] Guyot: "The Earth and Man," p. 308.
[45] Bunbury: "History of Ancient Geography," Vol. II, p. 43.
[46] Tozer: "Classical Geography," p. 5.
[47] Mooney: "Travel Among the Ancient Romans," p. 30.
[48] Sandys: "Companion to Latin Studies," p. 434.
[49] S. Walpole: "The Growth of the World," Cont. Review, Vol. 30, pp. 171-178.
[50] Mooney: "Travel Among the Ancient Romans," p. 30.

Africa was very limited;[51] but it is also evident that Roman history became a national and universal history of geographic comprehension and fusion.[52]

Thus far this discussion has been one of exploration and place geography, which is usually the result of either war or commerce; but there is another phase of the question—that of the scientific systematizing of the knowledge gained from these explorations and from mathematical calculations. This is the work of the student and philosopher. In geography it is not the exceptional fact, but the usual fact, that is of value.[53] From the great mass of confused and oftentimes seemingly unrelated facts, gained through many varied sources, it is the task of the scientific geographer to select the usual facts and arrange them in their natural order.

As has already been stated in this chapter, Homer was the founder of geographical science, and the one thing that he taught that has stood the modern scientific test is that the land is surrounded by a great sea.

Thales (640 B.C.) was the first Greek who taught that the earth is a sphere.[54] He divided the earth into five climatic zones, introduced the equator and the meridians, discovered that the plane of the ecliptic is inclined to that of the equator, and roughly measured that inclination.[55] He brought geography and geology into close connection, determined latitude and longitude from celestial observations, and was supposed to have invented the globe as a representation of the earth.[56]

According to tradition, the honor of making the first map, though a rude one, belongs to Sesostris, a supposed king of Egypt, who traveled extensively and made rough sketches of his journeys. Anaximander (610 to 546 B.C.) probably knew of such maps and improved upon them. His was the first attempt among the Greeks at map making.[57]

Aristagoras (about 550 B.C.), of Miletus, outlined the first map of the world.[58]

Hecatæus (500 B.C.) wrote the first geographical treatise,[59] and improved on the map of Anaximander; but the first work that was purely geographical—i. e., unmixed with the other sciences—was a

[51]Butler: "Geographia Classica," p. 25.
[52]Batsel: "A History of Mankind," Vol. III, p. 562.
[53]Douglas Johnson: "The Geography of History," Geographic Review, April, 1922.
[54]George A. Jackson: "The Beginnings of Science," Popular Science Monthly, Vol. XVI, p. 236.
[55]New International Encyclopedia: "Geography."
[56]Bill: "A General View of the World," p. 11.
[57]Strabo: "Geography" (translated by Falconer & Hamilton), Book I, Ch. I, 11.
Morse: "Universal Geography," Vol. I, p. 10.
[58]Harper's Classical Dictionary: "Geographia."
[59]S. Walpole: "The Growth of the World," Cont. Review, Vol. 93, pp. 171-178.
Mill: "International Geography," p. 26.

description of the Mediterranean coast written by Scylax at the beginning of the fourth century B.C.[60]

Aristotle (384 to 324 B.C.) proved that the earth is a sphere, using three arguments, two of which could be tested by observation: (a) the earth must be a sphere, because all objects tend to fall to a common center; (b) only a sphere could cast a circular shadow on the moon; and (c) as the horizon shifts, new constellations appear in the heavens.[61] We have no more proof to-day, except that we have circumnavigated the globe.[62] Aristotle also taught the variations of climate with latitude and longitude, discussed land forms, coast erosion, and dependence of plants and animals on physical surroundings.[63]

Pytheas (320 B.C.) tells of days and nights six months in length.[64]

Eratosthenes (276 to 175 B.C.), who is sometimes called "The Father of Scientific Geography,"[65] founded the first scientific system of all geographical knowledge. He was well equipped for this task by his knowledge of physical science, mathematics, history, and philosophy. He had access to the library at Alexandria, which was one of the best at that time,[66] and to all the materials collected by Alexander and his generals.[67] His city, too, was a fountain of science and knowledge, the residence of the most eminent literary and scientific men of the age.[68] By means of accurate measurements of the length of the sun's shadow at Alexandria and at the first cataract of the Nile, Eratosthenes calculated the earth's circumference to be about 25,000 miles.[69] He placed the science on so true a basis that the accuracy of his work is recognized even at the present time.[70] His original work, which was the most correct done before the sixteenth century A.D., has been lost, but the content has been preserved through the writings of Strabo and Pliny.

Hipparchus, of Nicea (140 B.C.), was the founder of mathematical geography, and first used latitude and longitude to determine the location of places. He employed a projection very similar to the one which we now have.[71]

Strabo (64 B.C. to 19 A.D.) followed the outline of Eratosthenes.

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[60] Harper's Classical Dictionary: "Geographia."
Bunbury: "History of Ancient Geography," Vol. I, p. 384.
[61] Williams: "History of Science," p. 183.
Ency. Brit.: "Geography."
[62] F. A. Ogg: "Geography from Homer to Columbus," Chautauquan, Vol. 32, p. 473.
[63] Ency. Brit.: "Geography."
[64] George A. Jackson: "The Beginnings of Geographical Science," Popular Science Monthly, Vol. XVI, p. 236.
[65] Williams: "History of Science," p. 226.
[66] Harper's Classical Dictionary: "Geographia."
[67] George A. Jackson: "The Beginnings of Geographical Science," Popular Science Monthly," Vol. XVI, p. 236.
[68] Bill: "A General View of the World," p. 11.
[69] New International Encyclopedia: "Geography."
[70] Bill: "A General View of the World," p. 11.
[71] Mill: "International Geography," p. 26.
Harper's Classical Dictionary: "Geographia."

His geography is perhaps the most important work on science left by antiquity. He condensed all the previous knowledge on the subject and to this added the result of his own personal observations gained by extensive travel.[72] He had access to the results of the survey of the whole Roman world which had been planned by Julius Cæsar by order of the senate. This survey was begun in 44 B.C. and finished twenty-five years later.[73]

This first work on general geography consists of seventeen books and is divided into four parts—mathematical, physical, political, and historical geography. It gives a sketch of the physical peculiarities and the natural productions of each country, and also says much of ethnology, trade, and metallurgy. Strabo's own definition of the science is this: "Geography unfolds to us the celestial phenomena and acquaints us with the occupants of land and ocean, the vegetation and the fruits, and the peculiarities of the various quarters of the earth, a knowledge of which marks him who cultivates it as a man earnest in the great problem of life and happiness."[74] Thus it may be observed that it is human interest upon which this ancient geographer places the greatest emphasis.

Practically no maps have been preserved from this ancient period, yet that they did exist is proved by the descriptions of them given by the classical writers. Mention has already been made of the map of Anaximander and the improvements made upon it by Hecatæus. Herodotus (484 to 424 B.C.) minutely describes an early map made for Aristagoras (who died in 497 B.C.), king of Miletus.[75] It is probable also that there were maps and guidebooks at an early date among the Romans.[76] From data obtained by the survey of Cæsar, Agrippa made a circular chart, which Augustus had engraved in marble and placed in a colonnade. This map is probably the foundation of our modern itineraries.[77] Livy says that there was a map of Sardinia in the temple of Mater Matuta as early as 174 B.C. Cicero, Propertius, Vitruvius, and Suetonius state that the Romans had both general and topographical maps.[78] Vegetius states that the military commanders had access to maps at an early date.[79]

It is not the purpose of this study to claim that the ancients knew geography as the well-organized science that is in use to-day. Naturally there would be many incorrect theories of geography in gen-

[72]Mooney: "Travel Among the Ancient Romans," p. 30.
Morse: "Universal Geography," Vol. I, p. 15.
[73]Mooney: p. 44.
[74]Strabo: "Geography" (translated by Falconer & Hamilton), Book I, Ch. I, 1.
[75]Ency. Brit., Ninth Edition: "Geography."
[76]Mooney: "Travel Among the Ancient Romans," p. 44.
[77]Mooney: "Travel Among the Ancient Romans," p. 45.
[78]Ibid: p. 44.
[79]Ibid: p. 44.

eral.[80] As one writer has said: "The geography from Homer to Columbus is a mingled ruin of discarded theories, but beneath a sea of errors flows a deep current of truth."[81] Much of ancient geography consists of notes on natural history interspersed with legends, traditions, and superstitions.[82] Added to these were theories of an unknown world, the realization that the known countries occupied but a small part of the earth's surface, and the supposition that other regions might exist separated from the known continents by a vast extent of ocean.[83] Several writers, both Greek and Roman, mentioned a large island, Atlantis, in the Atlantic Ocean, that finally was submerged beneath the sea. Beyond was a still larger continent.

Strabo suggested the probability of a western world. Seneca (54 B.C. to 39 A.D.) said: "The great earth will stretch out and the sea will disclose new worlds." Even the poets caught the spirit of the scientists and sang of the glories of the earth that were to be made manifest to the sons of men.[84]

Early generalizations are usually expressed by symbolic language,[85] and the Mediterranean basin is well adapted because of its physical conditions to be the birthplace of myths and fables. Here there are two centers of volcanic activity. On the north are the Alps, with their streams often swollen by heavy rains or by melting snows; on the south are the Great Desert and the mysterious Nile.[86]

Perhaps it is not so strange that in this early period there were fabulous geography and real geography,[87] and that it was often difficult to distinguish between the two; yet beneath this confusion ran "the deep current of truth" which was recognized by some of the educated men of that time.

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[80]Willard: "Ancient Geography," p. 10.
[81]F. A. Ogg: "Geography from Homer to Columbus," Chautauquan, Vol. 32, p. 473.
[82]W. Deecke: "Italy," p. 14.
[83]Mitchell: "Ancient Geography," p. 11.
[84]F. A. Ogg: "Geography from Homer to Columbus," Chautauquan, Vol. 32, p. 473.
[85]Ency. Brit.: "Geography."
[86]Ency. Brit.: "Geology."
[87]Heeren: "Antiquity," p. 11.

TEACHING
EDU. children
READING

THE TEACHER AND CHILDREN'S READING

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There is no individual who to-day has a greater opportunity in guiding children's reading than the teacher. Too often the parent is either indifferent or grossly ignorant of what the child should read. Consequently, the mediocre, and even the vicious, falls into the hands of the young, and a low standard is established. This works havoc with the taste for good literature. The librarian is willing and anxious to help, but he must wait for the child to come to him before he can give advice. Even then a full confidence must be established before his influence can count for very much with the child.

The teacher has every advantage. He has the child five days of the week. He has the pupil's confidence, for whatever teacher says is true, indisputable, beyond question. Then, too, the opportunity is afforded for knowing each child as an individual. The teacher can and should make a special case of each one, studying the background, the temperament, and the tastes of all under his care.

So, with this opportunity before him, it is nothing short of the teacher's duty to recognize the problem of children's reading and to cope with it in an intelligent, enlightened manner.

That the problem is with us there can be no doubt. Two distinct phases of it stand out most prominently. There is the child whose reading has been absolutely neglected, and there is the child who comes from the bookless home of nonreading parents. The former has been allowed, with the complacent remark that he would "not read enough to hurt him," to read whatever may have come his way. The latter knows nothing of the world of make-believe and unseen ships and far-off shores. Each of these constitutes a problem, and neither should be neglected. Probably more juvenile criminals have resulted from secretly hidden copies of *Nick Carter*, *Diamond Dick*, and the like, than from any other one source. So the effect of such reading is not merely negative, as so many negligent parents blindly suppose, but is positively harmful. And we cannot but pity the child who knows not books and is allowed to go through life without meeting Alice and the White Rabbit or Robin Hood and Little John. Fortunate, indeed, is the child who comes from that rare and cultured home where good books are as much a part of the daily family life as

breakfast and dinner. The problem would be more simple if there were not so much that is mediocre and common, entirely devoid of literary merit, being foisted on the young of to-day. Advertising is very clever. A choice of material must be made, and the teacher should be prepared to make this choice.

It is always safe to depend upon the classics, which have stood the test of time. The stories that have made them appeal to children through the years have done so because of intrinsic worth, and we may be sure that the style and subject-matter are worth while.

Though the teacher may be familiar with the standard works in children's literature, his problem is more than merely to suggest these. He must satisfy the need of the individual child at the right time. He must know something of the child's background, recognize his individual needs and wants, and then choose the book that best fits his particular case. To give a boy yearning for adventure a volume of fairy tales would be worse than useless; or to suggest to the fifteen-year-old girl who is longing for romance Kate Douglas Wiggin's "Bird's Christmas Carol" would be to shatter her confidence in the teacher's knowledge of books and human nature. Each of these is excellent in its place, but its place is not here. So it is necessary that the right book be given at the right time.

Since all work with children is being based more and more on the psychology of childhood, why should not children's reading be placed on the same basis? The teacher should familiarize herself with the characteristics and interest of the three stages of childhood—early childhood, later childhood, and early adolescence. Then, applying this knowledge to literature for children, she should be able to choose the type suitable for any age. For instance, in early childhood, love of rhythm, imagination, repetition, imitation, and love of animal stories are the chief inherent interests. To meet these, the *Mother Goose* rhymes, *Æsop's Fables,* the *Pied Piper of Hamelin,* and the *Three Bears* make their appeal. In the second stage, later childhood, the child enjoys the fairy tale or make-believe, loves combat, is a hero worshiper, and wants adventure. Hence, the more complex fairy tale, the classic myths, *Swiss Family Robinson,* and *Treasure Island* are favorites. In early adolescence the child is coming more into his own, is more introspective, is struggling to fit himself into the scheme of things, and longs for romance. Here especially should *Ivanhoe, Lady of the Lake, Tale of Two Cities,* and the like be given to instill the beginnings of the proper ideals of love and marriage. At this age especially should the sentimentality and false ideas of cheap fiction be suppressed.

There are many types of children's literature which should be stud-

ied and used—the fable, the fairy story, the myth, the classics, poetry, our modern stories of the home, the school, and adventure, stories of other lands, and our vast field of general reading. Each of these has its legitimate place in the child's reading, and the teacher should be prepared to suggest each at the psychological moment. There can be no set rule to determine when each of these makes its strongest appeal, for too much depends on the individual—his past reading, experience, tastes, and general aptitude. Yet a general idea can be formed. It is the teacher's privilege, with his intimate knowledge of each case, to guide the children's reading into these proper channels.

The one group of children's literature which cannot be stressed too strongly is the mythological group. It is indispensable. Its appeal covers a wide range in age; a suitable myth may be found for each stage of childhood. For the youngest children such simple, yet beautiful, myths as *Echo* may be employed. Hawthorne's *Wonder Book* and *Tanglewood Tales*, with their romantic atmosphere and simple style, make a strong appeal to young children. Kingsley's *Greek Heroes* should be read next. These retain the more classical atmosphere; hence their later appeal. The child, however, who misses Kingsley is to be pitied. Bulfinch's *Age of Fable* should be used by children in the latter part of the second stage of childhood, and Buckley's *Children of the Dawn* makes its strongest appeal in early adolescence. Mabie's beautiful Norse myths should not be overlooked, nor should Brown's *In the Days of Giants*.

When the teacher has studied carefully the problem of children's reading and feels that he has the material well in hand, there are several ways in which interest may be aroused. Probably the most simple and direct is the choice of a good story suited to the pupils in his care and read aloud to them. If the response is favorable, he can write on the board a list of similar stories, which can be obtained from either the school or public library. One story a week, carefully chosen from the various types of children's literature and well presented, would inaugurate an era of good reading among the pupils, which would have a lasting effect. In some cases a whole book, such as *Little Women*, might be chosen and only a portion of it be read, the remainder being left for the child to read for himself outside of the schoolroom.

Another opportunity which the teacher cannot afford to neglect is the chance for coöperation with the school and public librarians. By learning just what the library has to offer, by having a full understanding and sympathy with the librarians, he can send children to the library with the confidence that the best interests of the child will be served. He will also have the satisfaction of knowing not only

that the child is reading something worth while now, but that he is acquiring a habit of reading which will be of value to him throughout life.

The Parent-Teacher Association is another avenue which is open to the teacher. Here is the opportunity to gain a strong ally, if the matter is presented in the proper way. Parents should be made to realize the importance of the problem. The teacher is the logical person to present this. If he has a sincere interest in the subject and a full knowledge of the undertaking, he can undoubtedly gain the coöperation of those most vitally interested in the welfare of each child.

So the teacher of to-day should, first of all, realize the importance of the problem of children's reading and should realize his own responsibility in the matter. He should then familiarize himself with children's literature and fit the book to the need of the child. Then he should strive by every means of coöperation at hand to further the interest aroused in good reading.

EDU
Illiteracy

A BRIEF STUDY OF ILLITERACY IN THE UNITED STATES

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This paper assembles and interprets a few facts concerning illiteracy in the United States. It is based upon data gathered by the Census Bureau at different times, especially in 1920. Several graphs are employed to emphasize certain outstanding facts that are particularly interesting to the student of education. These are planned to stress especially the percentage relations, in the several census years, of the three outstanding groups in American population—the native whites, the foreign-born whites, and the negroes. Each per cent statement regarding each group is, of course, calculated from its own base—the total number of persons in that particular group.

Between the percentage statements about the three great groups an easily understood relationship always exists. Each numeral stated as a per cent represents also the actual number of individuals occurring among a typical unselected hundred persons of the group referred to, whether it be the total population or a group or class within the total population. The following illustrations will make this fact clear: Of the total population of the United States, in each typical unselected group of a hundred persons there were, in 1920, six illiterates. In 1880 there were seventeen. And among the native-born whites—excluding all other classes—there were in 1920 two illiterates and in 1910 three. Among the foreign-born white population there were, in 1920, in each typical unselected hundred, 13.1 illiterates. Among the negroes there were 22.9.

Data concerning illiteracy among Indians, Chinese, Japanese, and other nationalities or classes besides the three groups—native whites, foreign-born whites, and negroes—are neglected in this paper.

The term "illiterate" as used by the Census Bureau signifies inability to read, and refers only to persons 10 years of age and over. Hence, this study deals only with complete inability to read, not with inadequacy in reading, and with that portion of the population which is 10 years of age and over.

Before entering upon an examination of the present extent of illiteracy, we may note that a brief review of the early censuses reveals a few interesting facts—interesting chiefly because of their isolation.

The first census that reported statistics of illiteracy, that of 1840, recorded only statistics for *whites over 20 years of age* who were unable to read and write. The censuses of 1850 and 1860 gave the number, nativity, race, and sex of *free* illiterates 20 years of age and over. The first statistics recording the illiteracy among *all persons 10 years of age and over* were given in the census reports of 1870. The census reports of 1840, 1850, 1860, and 1870 are inferior to those of succeeding decades in that the compilations are not so detailed or complete. The statistics of illiteracy presented therein are really not exactly comparable with those of the later group except in one instance. The per cent of total illiteracy in the United States in 1870 was 20, and in 1880 it was 17. The earlier censuses are, because of their inadequacy, not used in this study.

Any inquiry into the present status of illiteracy in the United States is necessarily based upon statistics already several years out of date—those gathered by the Census Bureau in 1920. Charts 1 and 2 are compilations and arrangements of the 1920 census statistics. Chart 1 shows what percentage of the total population is illiterate—in each state, in the District of Columbia, in each large geographical division or homogeneous group of states, and in the United States as a whole. It also shows the percentage of illiteracy in each of the three major groups of population—native whites, foreign-born whites, and negroes. It visualizes the relations of the several percentages among the various groups. It points out the class that has the greatest per cent of illiteracy, whether it be native white, foreign-born white, or negro, not only for the United States as a whole, but also for each political or geographical division therein. Chart 2 ranks the states and graphs the percentage of the total population which is illiterate in each of the forty-eight states, the District of Columbia, and the United States as a whole.

The above-mentioned charts make graphic the following facts relative to the present status of illiteracy in the United States: The percentage of illiteracy to total population ranges, in the different geographical divisions, from 2 to 12.7. Three geographical divisions—the West South Central, the East South Central, and the South Atlantic states—have ten per cent or more of their total adult population illiterate. In thirteen states and the District of Columbia, belonging to these three geographical divisions, the greatest percentages of illiteracy among any group are among the negroes. In three states in these divisions the greatest percentages of illiteracy in any group are among the foreign-born whites.

In the six great geographical divisions other than those mentioned above, the greatest percentages of illiteracy in any group of popula-

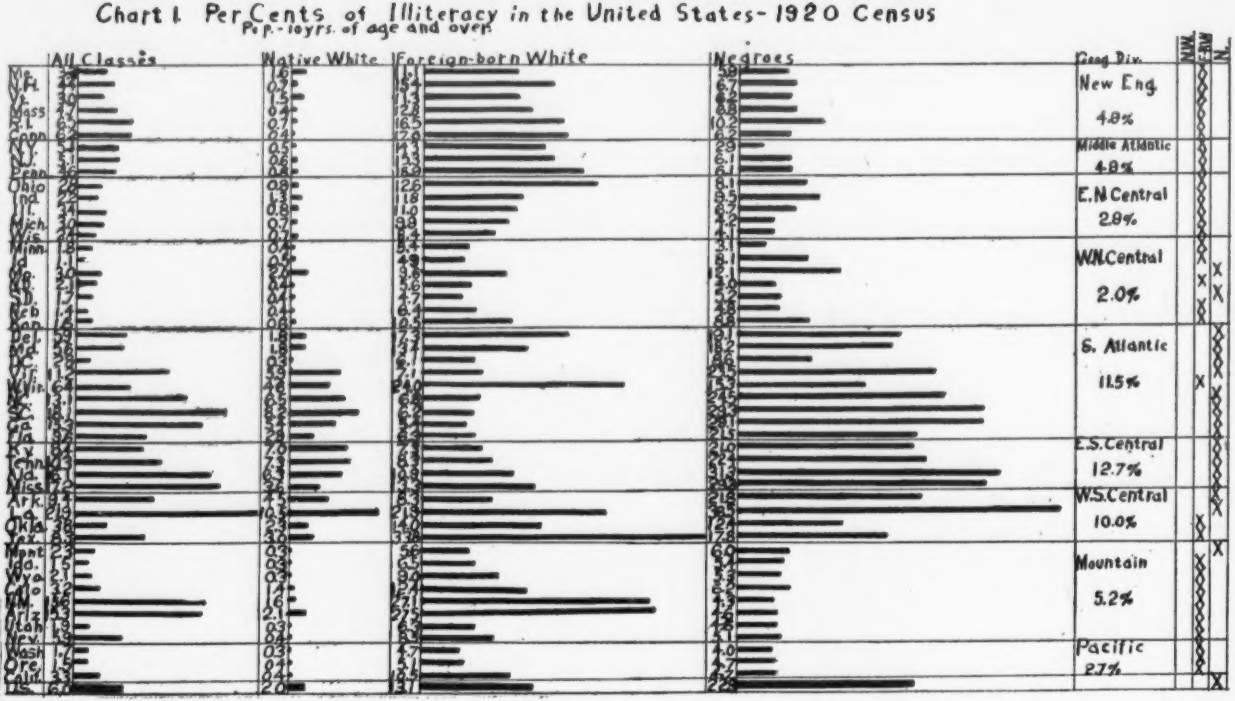


Chart I. Per Cents of Illiteracy in the United States - 1920 Census
Pop. - 10yrs. of age and over
All Classes
Native White
Foreign-born White
Negroes
Geog. Div.
New Eng. 4.8%
Middle Atlantic 4.8%
E.N. Central 2.8%
W.N. Central 2.0%
S. Atlantic 11.5%
E.S. Central 12.7%
W.S. Central 10.0%
Mountain 5.2%
Pacific 2.7%
Note Crosses at left indicate group having greatest per cent of illiteracy for each instance.

Chart 2. Per Cent Rank of States
Pop.-10 yrs. of age and over

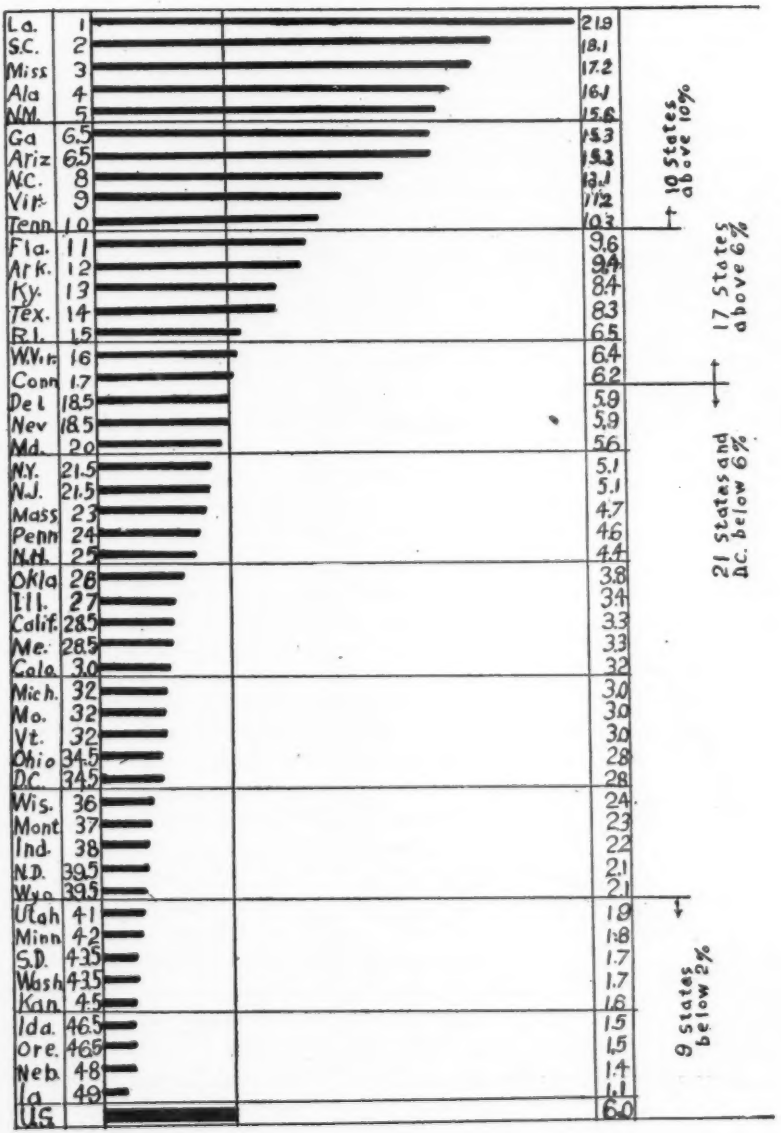


Chart 3.

Illiteracy Curves of Absolute Numbers
(Pop.-10yrs. of age and over)

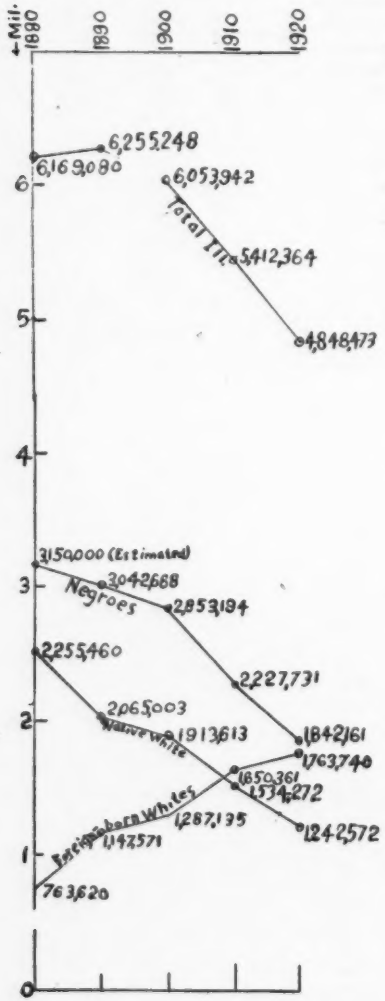
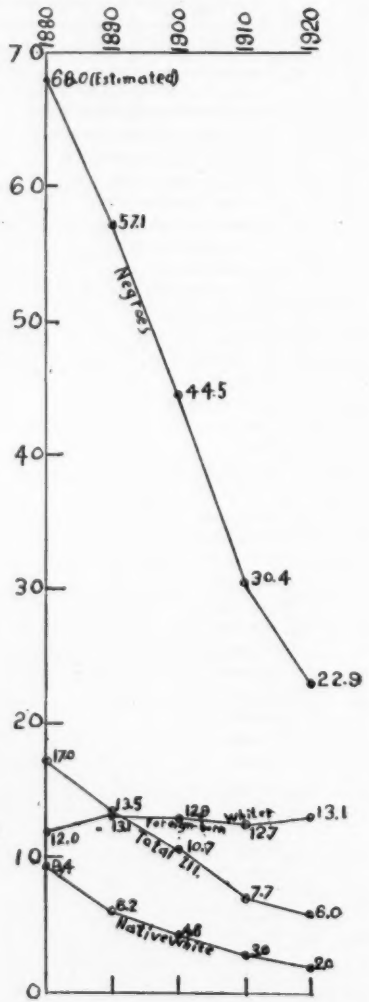


Chart 4

Illiteracy Curves of Per Cents
(Pop.-10yrs of age and over)



tion are, in twenty-nine states out of thirty-two, among the foreign-born whites; in only one state, Missouri, have the negroes the greatest percentage of illiteracy. In no state in the Union do the native whites lead in per cent of illiteracy.

In the total population of the United States 10 years of age and over the percentage of illiteracy to the entire citizenship is six. In the nation at large the group or class within the total population 10 years of age and over having the greatest per cent of illiteracy is the negroes. The percentages of illiteracy among the native whites range from 0.3 to 10.5; those among the foreign-born whites range from 4.7 to 33.8; and those among the negroes range from 2.9 to 38.5. Seventeen states have a greater per cent of illiterary and twenty-nine states and the District of Columbia have a lower per cent of illiteracy than the United States as a whole. Ten states have more than 10 per cent of illiteracy and nine states have less than 2 per cent of illiteracy. Iowa, with a per cent of 1.1, has the lowest percentage of illiteracy of any state, and Louisiana, with a per cent of 21.9, has the greatest.

A few facts concerning the present status of illiteracy which are not shown by the charts here presented are interesting. In the United States the per cent of illiteracy among males is 6, and among females is 5.9. In every one of the nine great geographical divisions the percentage of illiteracy to population decreased in the period from 1910 to 1920, and the per cent of illiteracy in the entire United States of course decreased also during this time. In three geographical divisions—New England, the East North Central, and the Pacific states—the total *absolute numbers* of illiterates increased. From 1910 to 1920 two states, Vermont and Nevada, decreased in total population. Ten states—Massachusetts, Connecticut, New York, New Jersey, Ohio, Illinois, Michigan, Texas, Arizona, and California—increased materially in per cent of illiteracy.

Illiteracy in South Carolina was reduced from 25.7 per cent of the total population in 1910 to 18.1 per cent in 1920. This is the greatest percentage reduction for any state during the decade from 1910 to 1920.

The greatest reduction in *absolute numbers* in any state during this decade was in Alabama, where the total number of illiterates in 1920 was 74,628 less than the number in 1910. In 1920 seven states—Indiana, Missouri, West Virginia, Kentucky, Tennessee, Oklahoma, and New Mexico—had their greatest absolute numbers of illiterates in any population group among the native whites.

A comparative study of the statistics of illiteracy in the United States in the last five censuses, aided by Charts 3 and 4, reveals in

most instances a notably steady decrease of illiteracy in the United States since 1880. Among native whites, both the total absolute number of illiterates and the percentage of illiterates are lower. Among the negroes the total absolute number of illiterates (the number for 1880 being estimated, because that report included in a single group negroes, Indians, Chinese, and Japanese) has greatly declined, and the percentage of illiteracy among them has strikingly diminished. The total absolute number of illiterates among foreign-born whites, however, has increased, as has also their percentage of the total in that group.

The percentage of white constituency of the entire population of the United States has increased in both the native and foreign-born groups. The percentage of negro constituency of the entire population has declined.

The total absolute number of illiterates in the United States has steadily declined, and the percentage of illiteracy in the total population of the United States has decreased from 17 in 1880 to 6 in 1920.

Interpretations from this study as they apply to educational administration indicate that educational effort throughout the United States has been effective in reducing the total percentage of illiteracy in the nation. They also indicate that for a material reduction of the percentage of total illiteracy in the future especial effort educationally must be made among the negroes. Very satisfactory progress is, however, being made by this group. The problem of a material reduction of the percentage of total illiteracy must be worked out chiefly in that section of the United States known as the South. The other states, however, also have an educational problem—the education of the foreign-born whites. It is interesting to note that in the states of Indiana, West Virginia, Tennessee, Kentucky, Oklahoma, Missouri, and New Mexico an additional problem is presented—the providing of better educational advantages for the native white population.

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A PLAN TO ENCOURAGE HOME READING

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It is natural for high-school pupils to want to read; and that perhaps most of them do read a good deal is an ascertainable fact. But this unguided reading is likely to be of very little value, either present or future, in their development. The English departments of many schools are now trying to learn how to guide into helpful channels pupils' general reading, without repressing it.

The Eatonton High School has for several years used a plan which is giving excellent results. Only a part of it is different from plans used by other schools, and I shall try to stress that portion.

We have four separate reading lists, one for each school grade. This provides variety. At the beginning of a year a pupil enters upon what seems to him a new vista, not merely a continuance upon the old. Each list is made as attractive as possible in terms of the tastes which we know children of that stage of development to have. Each comprises about fifty titles. The several lists are compiled from various standard current lists, chiefly the suggestions issued by the National Council of Teachers of English. We use the titles which, in our judgment, are best suited to our particular environment and pupils, and which, secondly, our facilities permit us to provide. We do not recommend books which pupils cannot easily obtain.

When a boy or girl has read a volume, he fills out and signs a small printed card informing the teacher that he is prepared to report upon this book when called upon.

This certificate of readiness is filed until the teacher has leisure to hear the report, which may possibly be called for later at very short notice. It may then be either written or oral, usually at the option of the pupil. After the report, the card, with a notation on it, remains permanently on file.

Every child is expected—under pressure, if necessary—to read nine books each year. This is the minimum. The several lists are classified according to different types of content and appeal (not literary form), and each pupil is further required to read at least one in each classification. Some stress is thus exerted toward a constant widening of interests.

The most conspicuous feature of our system has not yet been men-

tioned. We give formal certificates and diplomas regarding reading. These are of two sorts. Both are as beautifully printed, as elaborately signed, as well worth framing, and as formally presented as is a certificate of graduation, although they are not this and have no very direct bearing upon promotion or graduation. When a pupil has read thirty books in one year, he receives a *reading certificate*—a handsome specific statement of this fact, of which he may well be proud. After he has received three reading certificates and has qualified to receive a fourth—that is, after he has read during his high-school course 120 books, thirty each year—he is awarded a *reading diploma*. This document approximates in form and handsomeness a diploma certifying graduation from school. It is, in fact, a certificate, not of graduation, but of graduation *plus*. Few good students, indeed, would be satisfied to leave school without gaining it.

We do not, of course, rely upon certificates alone to motivate reading. We exert the same effort as other good schools to provide the atmosphere, stimuli, and opportunities which will make children want to read for sheer delight. But we find that the concreteness of the certificates and diploma and of the academic-social situation which centers automatically in them helps us greatly in achievement.

The first year we tried this plan I did not, of course, expect to award any diplomas; to attain the diploma level would require the seniors to read and report on 120 books in one year. As a matter of fact, I had to stretch our fourth-year reading list to meet an unexpected demand, and—to my great surprise—five, out of fifteen, seniors won the diploma. That same year about fifteen reading certificates were awarded, in our very moderate-sized school, to members of the three lower classes. It has been our experience that the outside reading does not cause neglect of studies or of other duties. The school honor pupils are almost certain to be among those with reading diplomas.

EDITORIALS

WE THANK YOU, ONE AND ALL

Our old friends, tried and true, have come to our support, and we are finding new friends every day. Could anything make life happier?

When we began to prepare the manuscript for Number 1, the PEABODY JOURNAL had just forty subscribers. We were they. A few irrepressibles joined us quickly. Almost contrary to expectations, the Business Manager had plenty of money to pay his first postage bills. When Number 1 came from the press, the subscription list stood at one thousand. It has now mounted to about twelve hundred. And this in the lean summertime! We therefore go to press happily with Number 2. These figures, however, are for subscriptions, not circulation. We printed four thousand copies of Number 1, and have circulated practically three thousand. Several of our friends will, no doubt, find gratis our handsome brown envelope when they come back from summer-cottaging in Michigan or Maine. And we know that they cannot resist it. We shall print four thousand of Number 2. Every one from now on, for a long time, will want his subscription dated from Number 1. We have, for instance, yet hardly heard from libraries at all. We know that by the end of our first year the early numbers will be scarce; for we are going to make the JOURNAL better and better—to make a file of it really worth having.

We thank you also for your letters. If they did you as much good as they do us, you have your blessing already. To us they are a great stimulus. We are sure that we can do better because you wrote them.

And so, as Tiny Tim observed, "God bless us, every one."

ANNEALED AND TEMPERED

In the making of steel tools, the final process is the most delicate. Coming from the flaming crucible, the glowing metal flows into the confines of its permanent shape and begins to trade its fervent heat for hardness and stability. Then it must be annealed and tempered.

Annealing is a privilege granted to metal molecules of settling themselves more comfortably. Slow cooling favors this; the metal

loses its brittleness. But—alas!—such comfort has a fatal weakness. The tool may not break, but it will yield. No cutting edge can be ground upon it.

So the tool must be tempered. This is the opposite of annealing, and is accomplished by reheating and sudden cooling. But here is danger. The highly tempered steel may not bend, but it will break. The skillful tool maker, therefore, both anneals and tempers.

Human spirits may become annealed by luxury, or contentment, into soft and yielding things; or by excessive temper they may break when they should endure. There must be a judicious mixture of the two conflicting natures in the truly useful spirit.

Especially is this true of the successful teacher. He is the tool that fashions civilization. In his breast the lion and the lamb must lie down together; he must be both annealed and tempered.

COURTESY

The president of a great university, not long since, went on a far journey. He was not personally unknown; he carried besides many good letters of introduction. In the far-off centers of culture, learning, and civic prosperity he called incidentally on not a few notable men. Some were professional men, some teachers, some college presidents, some bankers, and some the responsible heads of great business enterprises. "I wonder," he remarked pensively to a friend on his return, "whether we teachers are not losing our good manners." In all his long journey the only approach to discourtesies that he received were from educators. His card, presented at the office door of a great lawyer, a banker, or a business man, almost invariably brought instant cordiality, a brief chat, and expressions of personal willingness to be of service. Or if these failed, there was almost certain to be shortly a note at his hotel, regretting that he could not be received and often begging the pleasure of a luncheon engagement later. With schoolmen it was nearly always different—a wary, perfunctory office attendant, the great man too busy to receive callers, a card courteously left, and unbroken silence thereafter forever and ever. Business and the great responsible professions have learned long since the indispensability of courtesy and good fellowship. Shall education linger long behind?

HIS MAJESTY, THE JANITOR

Janitors are of two kinds—lords and servitors—and they ought to be neither. But just what the janitor should and can be, nobody yet perhaps quite knows. Too often he is altogether too near to nothing at all worth mentioning — underpaid, incompetent, in-for-life and therefore unambitious, just "the man who sweeps the floors," and is more or less a buffoon or an ogre to various sizes and sorts of pupils. And this, of course, ought not to be so.

But the quintessence of *janitorissimus* is arrived at in some of the cities which maintain an education "business" department quite separately from the office of superintendent of instruction. Then, if ever, is school-teaching come upon evil days. Woe to the teacher who cannot acclimate himself to a painting job just outside, or perhaps decidely inside, his door! Woe to him or to her who stays too late, or comes too early, or seeks entrance on a Saturday! Two schedules operating independently and with quite different objectives serve certainly not to expedite education, but rather well to placate labor unions and especially to provide ward politicians with a financed following. One of the most far-seeing, competent, and educationally important schoolmen in America is the principal of a city building whose janitor—heaven save the mark!—whose *engineer* receives hundreds of dollars more salary than he and is politically so much more important (in a city ruled by politicians) that his grammar, his idiosyncrasies, and his domineering can very profitably indeed be overlooked. Brains are trumps sometimes only. It's a queer world, this school world, when you look at it closely, isn't it?

HOW BIG THINGS ARE DONE

Do you want to do something big? Have you the desire to perform some gigantic task and become truly great in the eyes of men?

How about measuring a star? Not long ago Dr. Michelson, of the University of Chicago, determined the diameter of Betelgeuse, that star around which the imaginative eyes of ancient people saw the huge, bulging shoulder of the giant, Orion. It is the brighter of the two upper stars in that constellation.

Even astronomers were startled at its size—over 300 times the diameter, 90,000 times the surface, 27,000,000 times the volume of our sun. If the sun were placed in the center of Betelgeuse, our earth,

revolving around it at the average distance of 93,000,000 miles, would still be far inside the outer surface of this enormous star.

It was, indeed, a big thing—to put a yardstick beside a star so far away that light requires more than one hundred and fifty years to traverse the distance. By what marvelous magic was this accomplished?

As a spectacular performance, the determination was neither marvelous nor magical. The diameter of the biggest star simply involved the smallest angle it has ever been possible to measure. You have seen the play of colors where light falls upon a drop of oil which has spread out over water in a film of microscopic thinness, which, by means of these colors, can be measured in terms of billionths of an inch—the lengths of light waves. Michelson adjusted mirrors to catch the beams coming from opposite sides of Betelgeuse; he reflected them into the mammoth lens of the Mount Wilson (Cal.) telescope; he measured the "interference bands" and computed the angle between the paths of light. It was an angle with which we would measure a walnut 70 miles away, a baseball 200 miles distant, the height of a man 5,000 miles beyond the reach of our hands. But the angle was measured, and accurately; then a simple calculation by trigonometry gave the dimensions of the star.

Accomplish big things by doing little ones accurately and well. Do you wish to be a great writer? Study the commas, colons, dashes, and periods, the laws of their use, the mischief of their abuse. Would you sing so that thousands will gladly listen? Then train the vibrant throat strings, the mind, and the heart to perfect coördination in even the smallest trill. Shall you be a famous surgeon? Learn the location of every tiny muscle, nerve, and artery which your knife may cut.

Greatness comes easily to the daydreamer. For a time he feels the thrill of conquest, the delight of power, the inspiration of achievement, all imaginary. There is sure to be a reaction in which he will realize how foolish it is to applaud himself when he has done nothing. True castles are not built of air, but of patiently hewn stones, each chip removed with care and accuracy.

Ambitious people are frequently impatient with the little things. These seem to require an amount of attention out of all proportion to their size. The impetuous spirit feels that it is better to run than to walk, better to leap over a wall than to climb patiently, but surely. The importance of exactness impresses those who have proceeded further in their life work; for, being faithful in little, they often have become master over much.

This is a brief little lesson. Does it teach a big truth?

REVIEWS

CHAMBERS, MARY D. *Nature Secrets.* (*Little Gateways to Science* series.) Boston: Atlantic Monthly Press, 1923. Pp. 155.

What is the secret of Nature? What truth has escaped the notice of complacent minds? What inspiring fact does this little book intend to whisper into childish ears, revealing a source of knowledge which is, indeed, too often hidden from father, from mother, or—yes, even her—the teacher? It is a secret that must really be pointed out to most of us, and here it is: *The most common things are very beautiful.*

An early chapter is about dust; a middle one, about potatoes; a later one, about lamps. All stories are drawn from a rather unusual, but not unworthy, field for childish tales—chemistry. Related biology and physics are appropriately included; but "Miss Oxygen at Work and Play," "The Roundabout Rambles of Carbon," and "Lazy Boy Nitrogen" are typical themes. They are designed for children of the fifth and sixth grades.

The writer has seen many attempts to simplify science. To one who has not tried it nothing could appear easier. "I deal with higher mentalities," gushed a would-be highbrow; "but you, with children—O, it should be so sweetly simple to simplify!" But I, who have taught from the third grade on up into the college, marvel chiefly at the great educational mystery: How—O, how!—does the primary teacher ever show the babies how to read? That, I believe, is a task of such simplicity that it becomes a miracle.

True simplicity is the highest form of any art. Many attempts to make science plain have failed. Merely breaking the big words into syllables or injecting baby talk into the big ideas will not do it, although on my shelves are books that try this plan from cover to cover. "Children, listen!" commands the teacher. "Our text says: 'Coke, lime, and atmospheric ni-tro-gen, heated by electricity in the proper manner, form cy-an-am-id, which, by the action of steam and suitable cat-a-ly-ser, becomes ni-tric acid. This process is called artificial fix-a-tion.' Now, is that plain? I will question you. How is cyanamide made?"

Pupils: "In a pro-per man-ner."

Teacher: "Fine! Now, how is nitric acid made?"

Brightest Pupil: "With a suitable *cat-e-chism!*"

And one of our little group who listened—a chemist who remembered his Shakespeare—whispered: "I'll be d——, for e'en though I be the first, I must soon cry, 'Hold! Enough!'"

Mrs. Chambers does not do it this way, emphatically not. She tells a straight story to the youngsters. She enthuses them: "The shoals of golden clouds are painted upon dust," she says. She mystifies them: "Keep on adding water, and, presto, change! Like magic, isn't it?" She leads them: "Now, let us find out which part of the flame is the coolest." She preaches to them: "How often we have remarked on the surprising resemblance between the behavior of chemical elements and that of boys and girls!"

People of fifty years ago liked this sort of thing; and there were, perhaps, more books of "Conversations in Science for Children" in those days than now. Our generation, prolific in invention, may owe much to these awakeners of scien-

tific interest. The style is certainly worth passing on to our own boys and girls. *Nature Secrets* is worth while.

O, I almost forgot! The book escapes perfection. The illustrations are well selected, but too few for this type of text, and *very* poorly printed.

H. A. WEBB.

GAULT, ROBERT H. *Social Psychology, The Bases of Behavior Called Social.* New York: Holt, 1923. Pp. x + 336.

Social psychology to the author means, as applied to man, "the reactions of members of the human race one to another;" but these reactions are of various degrees of indirectness, as are also the methods of stimulation. Imagery of sorts is involved, and one may react to "what is 'in the air' " or he may do certain things just because "everybody else is doing it." The sense of unity among people is part of the consciousness of the individual alone. This unity comes about because we are responding to similar situations, and its elements are imagery of the reactions of others, purpose, and an affective or emotional state, which together are similar to Giddings' "consciousness of kind." This unity is in no sense to imply a social mind, but is to be regarded as strictly individualistic. The genetic view makes it clear that purposes, desired ends, ideas, etc., are not themselves motives, but only symptoms of motives. The real motive to action seems to the author to be the drives toward activity, which in the native undifferentiated form the author calls "instinct." From these grow instinctive acts; but instincts, in the plural, "as particular inborn mechanisms or dispositions supporting specific forms of behavior," do not exist. Instinct is modified by the environment into the various forms of activity observed, and human environment is, of course, a large element. The consciousness of unity can come only by interaction among individuals, and the various forms of behavior called "instincts" come about in this manner. Out of the various experiences, struggles, and adjustments come certain more or less definite types of drives or tendencies which, though not different in any essential from habit, may be called "complexes." Thus one comes to have one's political, moral, philanthropic, occupational, and other complexes, which may be called "final motives" in our social life. They are not mutually exclusive. In suggestion, mob action, and the like, one or another of the determining tendencies becomes somewhat dissociated from others and freed from their inhibitions, and thus comes into independent expression.

Considerable space is given to the various intellectual levels of different elements of society and of different races found in America, particularly of the negroes. The army test reports and other experimental investigations are drawn upon here as well as in the discussion of occupations and of various maladjustments. While proportionately too much space is given to factors not specifically belonging to social psychology, separate chapters appear on suggestion, the crowd and allied phenomena, and conventions and customs. The book shows the influence of broad social interests and of the author's occupation with various forms of maladjustment. A bibliography and questions and exercises are given in the appendix, as well as a sketchy description of the army tests so frequently referred to in the text.

JOSEPH PETERSON.

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